Health-Enhancing Physical Activity and Well-Being: Is it How Often, How Long, or How Much Effort that Matters? A Test of Basic Psychological Needs Theory

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Dedication

To my parents, Don and Lisa for their endless love, support and faith in me.

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Abstract

The primary objectives of the present study were 1) to examine the relationship between health-enhancing physical activity (HEPA) and well-being across the previous day and 2) to examine the role of basic psychological need satisfaction as a potential mediator of the HEPA – well-being relationship. Participants (N = 203) were a convenience sample of undergraduate students with data collected cross sectionally. HEPA was generally associated with well-being (r's ranged from .18 to .62). Multiple mediation analyses supported psychological need satisfaction as mechanisms underpinning the HEPA – well-being relationship. Subsequent analyses demonstrated that effort put forth in HEPA activities, as opposed to frequency or duration, uniquely predicted well-being. The role of effort was further highlighted in the multiple mediation analyses. As such future research may wish to investigate the utility of a HEPA program that facilitates effortful engagement and fulfillment of basic psychological needs.

Keywords: health-enhancing physical activity, well-being, Basic Psychological Needs Theory

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The Association between Health-Enhancing Physical Activity and Well-Being: Is it How Often, How Long, or How Much Effort that Matters? A Test of Basic Psychological Needs Theory

Contemporary references to positive health emanated from the work of Sigerist (1941) who identified a healthy individual as one "…who is well balanced bodily and mentally, and well-adjusted to his physical and social environment. He is in full control of his physical and mental faculties, can adapt to environmental changes … and contributes to the welfare of society according to his ability" as cited in Chatterji et al. (2002; p. 2). Building on Sigerist's (1941) conceptualization of health, the World Health Organization (WHO, 2005) described health as a state of "complete physical, mental and social well-being and not merely the absence of disease and infirmity" (p. xviii). Although not uniformly endorsed (e.g., Seedhouse, 1987; Seipp, 1987) further clarification of positive health was advanced "…in which an individual realizes his or her own abilities, can cope with the normal stress of life, can work productively and fruitfully, and is able to make a contribution to his or her community" (WHO, 2005, p. 2). Taken literally, this definition suggests that to be healthy, an individual must possess certain positive and enhancing characteristics, which cannot be achieved simply by the absence of being ill (Seedhouse, 1986). This definition led to the dichotomization of psychological health into ill-being and well-being. Empirical evidence has supported the aforementioned dichotomy (Kasser & Ryan, 1996; Niemiec, Ryan, & Deci, 2009; Ryan, Huta, & Deci, 2008) and suggests further that the absence of mental distress or psychopathology (i.e., ill-being) does not guarantee the presence of well-being (e.g., Manderscheid et al., 2010; Ryff et al., 2006).

Well-being

Discourse specific to well-being has integrated the field into two broad traditions consistent with hedonic and eudaimonic philosophy (Ryan & Deci, 2001; Ryff, 1989, 1995; Waterman, 1984, 1993). Hedonic (or subjective) well-being is the study of what makes life and its experiences pleasant and unpleasant (Diener, 1984). Hedonic well-being (HWB) consists of three components, two of which concern the presence of affect, either positive (e.g., pleased, excited) or negative (e.g., upset, anxious). The third component involves one's cognitive assessments of the extent to which an individual is satisfied with his/her life. In essence, estimates of affect ask participants to respond to items assessing how they are "feeling", whereas life satisfaction is more reflective and evaluative (de Haes, Pennink, & Welvaart, 1987). As measures of life satisfaction are reliant on the circumstances of people's lives, the reliability of scores from life satisfaction measures are increased relative to mood as indicators of overall well-being (Diener, Lucas, Schimmack, & Helliwell, 2009). While other conceptualizations of HWB exist (e.g., Lyubomirsky & Lepper, 1999), consideration of positive and negative affect and ratings of life satisfaction have received the bulk of empirical attention (Forgeard, Jayawickreme, Kern, & Seligman, 2011). Well-being researchers have advocated for the assessment of both affect and satisfaction information (e.g., Dolan, Peasgood, & White, 2006), with moderate positive correlations among these constructs noted (Gagné & Blanchard, 2007; Sheldon & Lyubomirsky, 2004).

Consideration of HWB portrays human nature as a passive condition with minimal information specific to the conditions associated with well-being (Chatzisarantis & Hagger, 2007; Ryan & Deci, 2001). The philosophical conceptualization underpinning

eudaimonic well-being (EWB), in contrast, establishes human nature to be an active process (Chatzisarantis & Hagger, 2007). With varied conceptualizations advanced (e.g., Csikszentmihalyi, 1975; Maslow, 1968; Ryff, 1989), EWB refers to living a meaningful life according to one's true self and the realization of human potentials through personal growth (Ryan & Deci, 2001; Waterman, 1984, 1993). Experiencing eudaimonia includes the pursuit of life goals which give purpose and meaning to one's life (Norton, 1976).

Research has demonstrated a pattern of moderate - strong positive relationships between scores derived from markers of hedonic and eudaimonic well-being (Gallagher, Lopez, & Preacher, 2009; Waterman, 1993). Despite the magnitude of association, support for the distinctive nature of these constructs has been gained (e.g., Gallagher et al., 2009; Ryff & Singer, 2006; Ryff, Singer, & Love, 2004; Waterman, 1984). Further, HWB and EWB have demonstrated different magnitudes of association with criterion variables including mortality and disease (Clark & Watson, 1991; Huppert & Whittington, 2003). These findings give reason to examine both hedonic and eudaimonic markers of well-being as consideration of one (e.g., HWB) to the exclusion of the other (e.g., EWB) may render health professionals understanding of well-being to be somewhat limited in scope (Ryan & Deci, 2001; Fredrick & Loewenstein, 1999).

Understanding Variation in Well-Being

Reviews (e.g., Diener, Suh, Lucas, & Smith, 1999; Dolan, Peasgood, & White, 2008) have looked to describe demographic determinants of well-being, with continued calls for explaining the behavioural processes that relate to well-being (e.g., social, health, physical activity) forthcoming (Diener et al., 1999). Researchers (e.g., Deci &

Ryan, 1991; Kopperud & Vitterso, 2007; Reis, 1994) have further advocated for heightened understanding of the process of well-being (i.e., what makes us enjoy specific situations) to enhance understanding of the mechanisms underpinning the promotion of well-being.

Personality factors have been identified as the most meaningful predictors of HWB (Diener et al., 1999; Kesebir & Diener, 2008; Lyubomirsky et al., 2005). Meta-analytic evidence found personality traits accounted for approximately 39 percent of the total variance in HWB with extraversion and neuroticism exerting the greatest influence (Diener et al., 1999; Steel, Schmidt, & Shultz, 2008). Mirroring HWB research, personality traits have demonstrated a relationship with EWB indices (Grant, Langdan-Fox, & Anglim, 2009). Research evidence demonstrating the role of personality on markers of well-being supports behavioural genetic studies which suggests that well-being, to an extent, is determined by our genetic make-up (Lykken & Tellegen, 1996). This relationship is referred to by the term 'hedonic set point' (or set range) which is indicative of a moderately heritable nature (Weiss, Bates, & Luciano, 2008).

Varying from the genetic nature of well-being, gender has been found to be an inconsistent predictor (Diener et al., 1999; Dolan et al., 2006). Other factors (e.g., ethnicity, culture) have also been shown to have an association with well-being (Diener, Oishi, & Lucas, 2003). Although somewhat equivocal (Diener et al., 1999), both cross-sectional and longitudinal research has suggested older people tend to report higher HWB than those who are younger as researchers speculate that older adults generally have greater contentment, less anxiety, and are less concerned with how others view them and are also more robust to criticism in their daily lives (Charles, Reynolds, & Gatz, 2001;

Diener & Suh, 1998; Roberts & Chapman, 2000; Sheldon & Kasser, 2001). Education level (Diener et al., 1999) and socio-economic status beyond a habitable threshold (Kesebir & Diener, 2008) have been shown to account for little variance in well-being. As such, money may be a necessary but insufficient predictor of HWB (Kesebir & Diener, 2008).

The importance of social relationships, (e.g., family, friends, intimate relationships, etc.) to enhancing one's psychological experiences (e.g., relatedness; Baumeister & Leary, 1995; Ryff & Singer, 2000) has been demonstrated to be a necessary component of well-being (Diener & Seligman, 2002). Further, physical health and well-being have been associated through various markers (Howell, Kern, & Lyubomirsky, 2007). Short-term associations between physical health and well-being has been documented (Cohen, Doyle, Turner, Alper, & Skoner, 2003; Cohen, Alper, Doyle, Treanor, & Turner, 2006) as individuals who reported higher levels of well-being were found to be less susceptible to a common cold/flu than those with lower levels of well-being. Similar results have been linked to long-term physical health as positive affect has been shown to predict longevity (Danner, Snowdan, & Friesen, 2001). Diener and Chan (2011) have recently published their work advocating for the causal relationship between well-being and health and longevity.

In sum, well-being may be explained (in part) by variation in personal disposition (e.g., genetics) and the general circumstances of people's lives (e.g., age, income). Additional determinants of well-being including how a person spends their time, has received minimal consideration in comparison (Kahneman, Krueger, Schkade, Schwarz, & Stone, 2004). Complementing existing knowledge, researchers and health

professionals may want to explore the role of specific activities that people engage in, including intentional activities (e.g., leisure pursuits, attendance at church) that translate into the promotion (or thwarting) of well-being (Lyubomirsky, Sheldon, & Schkade, 2005).

The Conceptualization of Well-being

The varied conceptual definitions of well-being advanced, and its divergent use in medical and socio-psychological models of health have rendered the understanding of the underlying phenomena partially unresolved (Diener, 2009; Locker & Gibson, 2006). These challenges have translated into an expansive choice of instruments and methodological approaches which may obfuscate conclusions emanating from this literature. While a detailed consideration of the measurement challenges associated with well-being is beyond the scope of this thesis, one central aspect (i.e., the conceptualization of well-being which drives operationalization) is deserving of elucidation.

Conclusions from well-being research are usually derived from data emanating from global estimates of positive emotions and satisfaction with life (Kahneman et al., 2004; White & Dolan, 2009). However, over-reliance on global assessments may fail to capture what people really experience in the moment and may be subject to memory biases such as the tendency to recall the most salient and most recent experience best (Kahneman, 1999; Schwarz et al., 2009). Extrapolating on the above, Schwarz et al. (2009) suggest that global estimates capture beliefs about one's experiences rather than the actual experiences themselves (Schwarz et al., 2009). There is no a priori way to decide what temporal period (e.g., a few weeks, to one's entire life) is best to understand

the factors that contribute to well-being as each time period may provide unique insights and biases (Schwarz et al., 2009). For example, in responding to instruments, individuals may consider the way they feel at the moment to determine how they have felt over a longer period of time.

Global accounts of well-being may be constructed by respondents based on varied pieces of information, including context (Schwartz & Strack, 1999). Consequently, our understanding of well-being may be complemented through consideration of various contexts (e.g., academic settings, social relationships; Amorose, Andersen-Butcher, & Cooper, 2009; Diener & Diener, 1996; Fox, Stathis, & McKenna, 2007). For example, research has demonstrated that physical activity is associated with markers of well-being experienced within the environment the activity is engaged in (Busseri & Rose-Krasnor, 2008; Fox & Wilson, 2008; Gunnell et al., in press) and the association between physical activity and well-being is stronger when contextual as opposed to global indices are utilized (Fox et al., 2007). Each assessment of well-being (e.g., global, contextual) contributes unique information to understanding well-being and should be used to make inferences in their respective manner (Schwarz et al., 2009).

Moving Beyond Global and Contextual Assessments: Episodic Events

Both global and contextual reports offer insightful information regarding the determinants and consequences of well-being which is embedded in individuals' recollection of and beliefs concerning various experiences. However, the ability to recollect details embedded in any context declines over time as information undergoes a predictable loss due to random and systematic retrospective biases (Robinson & Clore, 2002). It has been argued that perceptions of experiences better reflect actual feelings if

they are reported in closer proximity to when the experience occurred and if questions directly reference the actual experience (e.g., how do you feel about this bout of exercise?; Kahneman & Kruegar, 2006).

Episodic reports are those that detail specific moments and events from the recent past (e.g., previous 24 hours), enabling people to retrieve experiences and feelings associated with recent activities. Episodic reports depend on the available memory of specific episodes and once a certain amount of time has elapsed, episodic information is no longer accessible. Therefore, individuals should report the episodic experience as close to the actual event as possible for optimal recall. Concurrent reports such as the experience sampling method (ESM; Csikszentmihalyi, & Larsen, 1987) and ecological momentary assessment (EMA; Stone, Shiffman, & DeVries, 1999) in which participants report their activities, feelings and possibly physiological events at several times throughout the day, have been described as the gold standard for assessing hedonic experiences (Kahneman et al., 2004). However, these techniques have a number of drawbacks (Scollon, Kim-Prieto, & Diener, 2003) including expense, high levels of participant burden which may encourage self-selection and/or attrition concerns, reactivity that interrupts participant experience, and the provision of minimal information about uncommon or brief events (Schwartz et al., 2009). One strategy to bridge the strengths and weakness of episodic reporting is the Day Reconstruction Method (DRM; Kahneman et al., 2004). DRM is designed to assess individuals' activities and experiences of the preceding day which has the advantage of limiting reports to very recent episodes recalled in the context of other episodes of the day. Results emanating from DRM research (Schwarz et al., 2009) have been shown to capture what people

experience in situ while overcoming the high cost and burden placed on the respondent. DRM asks participants to recall the preceding day and has been shown to replicate findings of experience based sampling techniques in a more efficient manner (Csikszentmihalyi & Larsen, 1987; Kahneman et al., 2004; Stone et al., 1999). While it is recognized that DRM is a retrospective method (like global assessments), it holds the potential for more fine-grained data and further opportunities to explore moment-to-moment feelings which has limited researchers in the past (Schwarz et al., 2009). Quantitative reports about time use and the frequency and intensity of reported HWB and EWB have been valuable in measuring the activities which contribute to the well-being of individuals (Kahneman et al., 2004; White & Dolan, 2009).

Promoting Well-being

While recognizing the inheritable nature of well-being (Lykken, 2000), emerging evidence suggests that well-being can be increased (Lyubomirsky et al., 2005). As a consequence, developing an understanding of the activities that enhance one's well-being- both hedonic and eudaimonic dimensions- is a worthy scientific goal.

Lyubomirsky et al. (2005) identified three factors and their relative contribution to one's well-being- genetic set point (50%), circumstantial/contextual factors (10%), and the intentional activities that one engages in (40%). More specifically, an individuals' genetic set point refers to a predetermined disposition for well-being based on their genetic make-up, whereas circumstances include life events (e.g., getting married, starting a new job, presence of a chronic health condition, etc.). Life experiences and the environment in which one lives, combined with genetics, serve a role in promoting or detracting from well-being (Lykken, 2000; Lyubomirsky, 2001; Sheldon & Lyubomirsky,

2007). Arguably the most promising means of increasing well-being is through intentional activities which are discrete actions or practices people choose to engage in which require effort (Lyubomirsky et al., 2005). Lyubomirsky et al. (2005) argue that well-being can be maintained/enhanced through a focus on intentional activity as opposed to life circumstances. As people adapt to changes in their life circumstances (e.g., a new home, what a person drives), novel positive experiences can be gained through engagement in new life activities (e.g., leisure pursuits; Sheldon & Lyubomirsky, 2006). In other words, the activities people engage in during a day are identified as contributing to an individual's well-being.

Intentional activity has been linked to well-being through the influential role of behaviours such as volunteering and outdoor activities (White & Dolan, 2009) as well as showing kindness towards others (Magen & Aharoni, 1991). Furthermore, striving for important goals (Sheldon & Houser-Marko, 2001), and devoting effort to meaningful causes has demonstrated associations with improved well-being (Snyder & Omoto, 2001). Interventions targeting well-being have demonstrated their utility for increasing HWB (e.g., Fava, Rafanelli, Cazzaro, Conti, & Grandi, 1998; Fordyce, 1977, 1983; Langer & Rodin, 1976; Litchter, Haye, & Kammann, 1980; Sheldon, Kasser, Smith, & Share 2002). For example, interventions prompting participants to count their blessings (Emmons & McCullough, 2003), to forgive others (McCullough, Pargament, & Thoresent, 2000), and pursue meaningful goals (Sheldon & Elliot, 1999) have translated into improved individual well-being. Continued investigations into the varied activities which contribute to the association between intentional activities and well-being, and the magnitude of the relationships have been advocated (Lyubomirsky et al., 2005).

Promoting Well-being: A Role for Health-Enhancing Physical Activity?

Health-Enhancing Physical Activity (HEPA; Bouchard, Blair, & Haskell, 2007) is characterized by any bodily movement produced by the skeletal muscles that increases the rate of energy expenditure. Acknowledging its multifaceted nature, HEPA is not limited to structured forms of exercise, but combines pursuits such as leisure activities, commuting, and occupational activities engaged in for a minimum of 10 continuous minutes (Bouchard et al., 2007). Research has supported the engagement in physical activity as being related to higher scores of psychological well-being (Blacklock, Rhodes, & Brown, 2007; Kramer & Erickson, 2007; McAuley & Katula, 1998; Netz, Wu, Becker, & Tenenbaum, 2005; Vuillemin et al., 2005; Wendel-Vos, Schuit, Tijhuis, & Kromhout, 2004). Although research investigating the relationship between physical activity and well-being has predominantly investigated structured exercise (e.g., fitness classes; Acevedo & Ekkekakis, 2006), various modes of physical activity have demonstrated positive small-to-moderate associations with well-being (Blacklock et al., 2007; Edwards, Ngcobo, Edwards & Palavar, 2005; Fox et al., 2007; Netz et al., 2005).

With a focus on markers of HWB, differential patterns of results depending on marker have been supported. For example, a positive moderate association between physical activity and positive affect has been noted (Biddle, Fox, & Boutcher, 2000), however a pattern of negative weak or negligible relationships ($p > .05$) with negative affect has also been demonstrated (Ozetkin & Tezer, 2009; Wilson, Mack, Blanchard, & Gray, 2009). Finally, the relationship between satisfaction with life and physical activity has shown inconsistencies in the literature as patterns of correlations have at times (Blacklock et al., 2007) failed to show associations (Warburton, Katzmarzyk, Rhodes, & Shephard, 2007). Considerably less research attention has been devoted to the link

between eudaimonic forms of well-being and physical activity with equivocal results noted (Brassai, Piko, & Steger, 2011; Ferguson, Kowalski, Mack, Wilson, & Crocker, in press; Mack, Wilson, Gunnell, Gilchrist, Kowalski, & Crocker, under review). The varied conceptualizations and analytic strategies applied to the physical activity – EWB relationship may help explain the inconsistent findings emanating from recent literature.

Biddle and Ekkekakis (2005) called for well-being research to not only focus on global indices but also contextual life domains as research has shown that physical activity is related to scores of psychological well-being. Furthermore, Kahneman and Riis (2005) argued that experienced well-being should be measured as global and contextual levels as unique insight may be gained from these complementary approaches. When examined at the episodic level, Kahneman et al. (2004) found physical activity to be above mean affect ratings of other activities (e.g., work, family) engaged in over the course of the previous day. This finding is particularly notable given that physical activity was reported by a small percentage of the sample and engaged in over a short duration of one's day, but still had a relatively large contribution to well-being in relation to other activities (Kahneman et al., 2004; Parisi, 2010; White & Dolan, 2009). Similar findings emerged when mean EWB ratings for physical activity were compared to other activities engaged in during the day (White & Dolan, 2009).

Studies adopting DRM have considered not only whether an activity is engaged in, but also the duration of engagement. Consideration of duration holds links not only to minimum recommendations for health (Health Canada, 2011), but extends to whether 'more is better' when linking physical activity to well-being. As Lyubomirsky et al. (2005) suggest that intentional activities that require effort may be the most effective

means through which well-being may be increased, consideration of effort put forth in physical activity (a proxy measure of relative intensity; CDC, 2011) should be considered. Cerin, Leslie, Sugiyama, and Neville (2009) have advocated for consideration for the frequency, duration and effort of physical activity on markers of well-being in an effort to advance the literature and offer practical recommendations for health promotion professions.

The Utility of Theoretical Frameworks in Empirical Inquiry

Michaelson and colleagues (2009) highlighted that as meaningful as it is to know an individual's well-being, the "…interesting question is why" (p. 56). Although reviews have found physical activity to have a small positive association with aspects of health and well-being (e.g., Biddle & Ekkekakis, 2005), the specific nature of the relationship is not yet understood (Warburton et al., 2007). Much of the literature investigating the relationship between physical activity and well-being has been atheoretical (Grant, Wardle, & Steptoe, 2009) or utilizes a restricted range of constructs (e.g., self-efficacy, social support, and fatigue) to explain the relationship (McAuley, White, Rogers, Motl, & Courneya, 2010; Motl & McAuley, 2009). Theory is an organized system of accepted knowledge that allows explanation of events or situations through specifying relations among variables (Glanz, Lewis, & Rimer, 1997). A theoretical framework allows researchers to select relevant predictors and offer possible explanations (mechanisms) of outcomes. Though varied psychological well-being (e.g., Set Point Theory, Lykken & Tellegen, 1996; Multidimensional Model of Psychological Well-being, Ryff & Singer, 2008) and health behaviour theories/models (e.g., Theory of Planned Behaviour, Ajzen, 1991) exist, most neglect the process of developing well-being. For example, the model

advanced by Ryff and Singer (2008), describes outcomes associated with EWB (e.g., environmental mastery) but not the mechanisms through which well-being can be developed. Further, many of the health behaviour theories focus on behavioural outcomes such as physical activity, as opposed to well-being outcomes. However, one theory which provides insight into the development of optimal functioning and well-being is Self-Determination Theory (SDT; Deci & Ryan, 1985, 2002).

Self- Determination Theory

SDT (Deci & Ryan, 2002) is a theoretical framework which holds the assumption that "individuals have natural, innate, and constructive tendencies to develop an ever more elaborated and unified sense of self" (p. 5). Five "mini theories" comprise SDT's framework including Causality Orientations Theory, (COT); Cognitive Evaluation Theory, (CET); Organismic Integration Theory, (OIT); Goal Contents Theory (GCT) and Basic Psychological Needs Theory, (BPNT; Deci & Ryan, 2002). These "mini theories" complement one another to form a unified approach to human growth and development. COT addresses personality-level constructs to examine differences in the extent to which individuals' are oriented towards self-determined versus controlled functioning across life domains (Deci & Ryan, 2002). CET concerns the conditions (e.g. competence and perceived autonomy) within social contexts that form (or diminish) intrinsic motivation (Deci & Ryan, 2002). OIT consists of a differentiated approach to understanding extrinsic and intrinsic motives which vary along a continuum of internalization (Deci & Ryan, 2002). Consistent with Deci and Ryan's (2002) suppositions, more autonomous (e.g., self-determined) motives predict behavioural engagement and enhanced well-being. GCT stems from how intrinsic and extrinsic goals impact motivation and wellness and is

based on the idea that goals are differentially associated with well-being as they may (or may not) target the satisfaction of key basic psychological needs (Ryan, 2009). Of greatest relevance to the objectives of the present study is BPNT which identifies that the fulfillment of basic psychological need satisfaction as foundational to promoting (or detracting) well-being (Deci & Ryan, 1985, 2002).

What is a Psychological Need? Deci and Ryan (2000) posit that psychological needs are innate and essential for ongoing psychological growth, integrity, and well-being. Psychological needs give goals their psychological potency and are important for understanding the content and process of goal pursuits (Deci & Ryan, 2000). According to Deci and Ryan (2002) psychological needs represent innate requirements rather than physiological forces or acquired motives. Evolving from the work of Hull (1943) and Murray (1938), needs as conceptualized within SDT are not seen as physiological or simply as a force motivating thoughts and actions (Deci & Ryan, 2000). Basic psychological need satisfaction has universally positive effects for all individuals as they promote engagement in environments that foster our needs (Ryan & Deci, 2002). One's potential can be optimized through psychological need satisfaction and can be the result of any positive social situation. Conversely, when psychological needs are frustrated, negative consequences such as ill-being, maladjustment, and increased fragmentation ensue (Ryan & Deci, 2001). Consistent with Deci and Ryan (2002), there are (a minimum of) three basic psychological needs (competence, autonomy and relatedness), which provide a basis for categorizing aspects of an experience as nurturing (or detrimental) to one's psychological well-being (Deci & Ryan, 2000). Competence refers to being effective in the social environment a person finds themselves in (White, 1959;

Deci & Ryan, 2002). Autonomy refers to being the principal agent of our own lives (DeCharms, 1968; Deci & Ryan, 2002). Finally, relatedness reflects feeling a meaningful connection with others in a social milieu, to interact with them and care for them (Baumeister & Leary, 1995; Deci & Ryan, 2002).

Basic Psychological Needs Theory. Numerous studies have demonstrated a positive psychological need fulfillment-well-being relationship with small-to-moderate effects noted (Deci, Ryan, Gagné, Leone, Usunov, & Kornazheva, 2001; Sheldon & Krieger, 2007; Vansteenkiste, Lens, Soenens, & Luyckx, 2006; Véronneau, Koestner, & Abala, 2005). Mediation analyses have extended this evidence to demonstrate a direct relationship between psychological need satisfaction and well-being (Meyer, Enström, Harstveit, Bowles, & Beevers, 2007). Further support for the tenents of BPNT have been demonstrated across two levels of analysis (between and within-person) as daily fluctuations in need satisfaction predicted variation in daily well-being (Sheldon, Ryan, & Reis, 1996). Furthermore, Sheldon et al. (1996) linked this relationship to short term daily fluctuations as psychological need fulfillment of competence and autonomy predicted variation in daily well-being. As hypothesized by Deci and Ryan (2002) these results were replicated with the need for relatedness (Reis, Sheldon, Gable, Roscoe, & Ryan, 2000). Howell, Chenot, Hill and Howell (2009) extended these findings by demonstrating that when psychological need satisfaction was assessed at the end of the day, all posited psychological needs were associated with increased well-being, but when individuals reflected hour by hour, only autonomy and relatedness were associated with positive affect, while competence was associated with negative affect. This offers a possible explanation why individuals may actively engage in activities associated with

temporary negative affect such as work and academics (competence-enhancing behaviours) that (at the end of the day) may contribute to their well-being (Howell et al., 2009).

Basic Psychological Needs Theory in the Context of Physical Activity: An Overview of the Evidence. Ryan (1995) argued that domain specific research is essential for widespread applied significance. Additionally, calls for continued investigation of BPNT (Deci & Ryan, 2002) in physical activity contexts have been forthcoming (Lloyd & Little, 2010). Support for BPNT (Deci & Ryan, 2002) in diverse physical activity contexts has been demonstrated (e.g., Reinboth & Duda, 2006; Mack, Wilson, Oster, Kowalski, Crocker, & Sylvester, 2011; Vlachopoulos, & Michailidou 2006; Wilson, Longley, Muon, Rodgers, & Murray, 2006; Wilson et al., 2009; Wilson, Mack, Gunnell, Oster, & Gregson, 2008; Wilson, Mack, & Lightheart, 2008). Furthermore in a diary-based study by Gagne et al., (2003) it was found that daily psychological need satisfaction predicted increases in daily well-being among athletes. In a longitudinal design (Edmunds, Ntoumanis, & Duda, 2007) a dynamic relationship between psychological need satisfaction and well-being in exercisers was found to be consistent with SDT. The fulfillment of the psychological need for autonomy accounted for increasing amounts of variance in well-being over a three month time span in a sample of overweight and obese individuals (Edmunds et al., 2007). Further, research has also demonstrated the relationship between psychological need satisfaction and well-being fluctuated systematically over time (Edmunds, Ntoumanis, & Duda, 2008; Wilson et al., 2006). Within physical activity studies that incorporated measures of well-being and BPNT, results across cross-sectional and longitudinal designs have demonstrated

positive small-to-moderate relationships (e.g., Wilson et al., 2006; Wilson et al., 2008; Wilson et al., 2009). Missing in the physical activity-BPNT-well-being literature is an episodic assessment of relationships between constructs. Studies applying BPNT to physical activity contexts have not always supported the theory's tenents (i.e., that satisfaction of the three psychological needs has a direct influence on well-being; McDonough & Crocker, 2007; Wilson et al., 2008; 2009; Wilson & Muon, 2008) and warrant further empirical inquiry. Research conducted in exercise settings (Wilson et al., 2009) has shown that all specific psychological needs may not be satisfied in this environment; as such the manner in which psychological needs are fulfilled may vary by context.

Research Objectives and Hypotheses

The first objective of the present study was to examine the relationship between HEPA and well-being when both constructs are assessed based on experiences from the previous day (i.e., at the level of the episode). A secondary objective was to examine the role of episodic psychological need satisfaction as a mediator of the episodic HEPA – well-being relationship.

Based on study objectives and review of relevant literature, the following hypotheses were put forth in the present study.

1. It is hypothesized that episodic HEPA will be positively associated with hedonic and eudaimonic well-being across the previous day. This hypothesis is consistent with existing literature (e.g., Brassai et al., 2010; Gunnell et al., in press; Wilson et al., 2009) that has examined the physical activity – well-being relationship at either the global or contextual level.

It is further hypothesized that the pattern of relationships between HEPA and well-being as assessed across the previous day will hold after statistically controlling for global indicators of well-being (Kahneman & Riis, 2005).

2. Episodic fulfillment of the psychological needs for competence, autonomy, and relatedness will demonstrate a pattern of small-to-moderate positive associations with episodic HEPA (Wilson et al., 2006; Wilson et al., 2008; Wilson et al., 2009).
3. Consistent with theory (Deci & Ryan, 2002) and empirical literature (e.g., Wilson et al., 2008), a positive relationship between episodic psychological need satisfaction and well-being in episodic HEPA contexts was hypothesized.
4. Based on SDT (Deci & Ryan, 1985; 2002) and previous research (Gunnell et al., in press; Mack et al., under review; Vallerand & Losier, 1999; Vallerand & Ratelle, 2002), it was hypothesized that episodic perceived psychological need satisfaction would mediate the episodic HEPA-well-being relationship.

Study Significance

The present investigation extends the literature examining the relationship between episodic HEPA, episodic psychological need satisfaction and well-being across at least three notable lines of inquiry. Areas of extension span conceptual considerations, theoretical development, and the sampling frame.

Conceptualization. The bulk of empirical literature examining the factors which contribute to (or detract from) well-being have been based on conclusions derived from global (Kahneman et al., 2004) or contextual (Fox et al., 2007) markers. Specific consideration of the relationship between physical activity and well-being has mirrored the general literature with respect to the conceptualization of well-being (Blacklock et al., 2007; Vuillemin et al., 2005; Wendel-Vos et al., 2004). An exclusive focus on retrospective evaluation is untenable if global evaluations do not accurately reflect the quality of the actual experience (Kahneman et al., 2004). It has been argued that experienced well-being should be measured separately as it can provide unique insights that are not addressed by global estimates (Kahneman & Riis, 2005). The use of procedures consistent with DRM adopted in the present investigation assists researchers and health promotion specialists to gain heightened understanding into time-use and how HEPA contributes to an individual's well-being. An episodic report linking HEPA and well-being advances our insight through improving our understanding of the small, meaningful relationship commonly found between physical activity and well-being (Biddle & Ekkekakis, 2005; Warburton et al., 2007) by examining the relationship at a different level of measurement.

One further conceptual consideration is advanced in the present investigation. In their review of the extant literature, Warburton et al. (2007) reported inconsistencies pertaining to cognitive evaluations (e.g., satisfaction with life) as opposed to affective evaluations (e.g., positive affect) of well-being as applied to physical activity in healthy young adults. Similar findings have been noted in the general well-being literature (Forgeard et al., 2011; Helliwell & Barrington-Leigh, 2010). Clarification of the nature

of HEPA on diverse markers of well-being warrants greater investigation (Biddle & Ekkekakis, 2005) and will receive consideration in the present investigation.

Finally, this study will address calls for future investigations to further examine different aspects of physical activity (i.e., frequency, duration and intensity) to understand the conditions for achieving psychological benefits (Cerin et al., 2009; Thogersen-Ntoumani & Ntoumanis 2005). Further, research conducted on undergraduate cohorts has documented that university students on average do not accrue sufficient physical activity for health (Colley et al., 2011; Irwin, 2004; Mack, Wilson, Lightheart, Oster, & Gunnell, 2010). Our understanding of the extent to which university students engage in HEPA at levels to enhance health is minimally understood in comparison to adults (Wendel-Vos et al., 2004) and symptomatic cohorts (Beckerman, de Groot, Scholten, Kempen, & Lankhorst, 2010). Consequently, further understanding of the relationship between HEPA and well-being may offer important insight for this population.

Theoretical Development. Meta-analytic evidence (Netz et al., 2005) has called for future research to determine mediating variables underlying the link between physical activity and well-being such that physical activity programs can be successfully implemented. Testing potential fulfillment of SDT's psychological needs as mediators (Vallerand & Losier, 1999; Vallerand & Ratelle, 2002) is significant to enhancing our understanding of the HEPA-well-being relationship and the mechanisms occurring within BPNT (i.e., fulfillment of the psychological needs). Further, BPNT as a useful framework for understanding eudaimonic well-being has been argued (Ryan & Deci, 2001). As a result, extant literature will be extended to further clarify mechanisms

underlying the relationship between daily HEPA and markers of episodic psychological well-being.

Methods

Participants

Participants (N = 203) were undergraduate students enrolled in Brock University. A priori power analysis (n = 176) was based upon a fixed alpha level (α = .05), a moderate effect size (r = .50), and a conservative power estimate (β = .80; Cohen, 1992). Oversampling occurred to account for those who did not report HEPA for the previous day. Participant recruitment was guided by the following inclusion criteria: (a) enrolled in courses at Brock University, (b) over the age of 18 years, and (c) able to read and converse in English.

Measures

Demographics. Demographic variables were collected for descriptive purposes and included: age, gender, educational attainment, marital status, ethnic origin and a single item (yes/no) question examining the presence of a chronic health condition.

Well-Being. Well-being was measured through the components of HWB as well as through one conceptualization of EWB.

Affect. Global reports of affect were measured through the 10-item Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegren, 1988), which has been recommended for brief measures of affect (Kercher, 1995). The 10-items used reflected both positive (n = 5; excited, enthusiastic, alert, inspired and determined) and negative (n = 5; distressed, upset, scared, nervous and afraid) dimensions of affect typically experienced (Kercher, 1995). The response scale ranged from 1 (*very slightly or not at*

all) to 5 (*extremely*), with higher scores reflecting greater levels of positive and negative affect. Items comprising each subscale (i.e., positive affect and negative affect) were averaged to form each scale score for each participant.

Confirmatory and exploratory factor analysis (Kercher, 1995) replicated previous research (Watson et al., 1988) which indicated structural and discriminant validity for PANAS scores. Mackinnon et al. (1999) concluded that the 10-item PANAS measured general positive and negative affect as effectively as the 20-item version. Construct validity for test scores was further corroborated by research examining the use of the 10-item PANAS across the lifespan (Mackinnon et al., 1999) with invariance for age demonstrated. Coefficient alphas (Cronbach, 1951) for global (α's > 0.75) (Kercher, 1995; Mackinnon et al., 1999) and exercise contexts (α's > 0.85; Wilson et al., 2009) for the 5-item positive and negative affect scores have been reported. Non-significant correlations between negative and positive affect (r = -0.02, p > .05) have been noted demonstrating divergent validity (Hilleras, Jorm, Herlitz & Winblad, 1998; Kercher, 1995).

Episodic assessment of affect was conducted adopting the 9-item Adjective Checklist (ACL; Diener & Emmons, 1985). Participants were asked to indicate how much they felt each of the following during each identified HEPA episode: 1) Pleased, 2) happy, 3) enjoyment/fun, 4) joyful, 5) worried/anxious, 6) frustrated, 7) angry/ hostile, 8) unhappy and 9) depressed/blue. Episodic positive affect was assessed via 4 items, with negative affect measured with 5-items. The response scale ranged from 1 (*not at all*) to 7 (*extremel*y) scores for each construct were averaged within each participant, higher scores reflect greater levels of positive and negative affect. Ryan, Bernstein and Brown

(2010) found the alpha coefficients (Cronbach, 1951) for positive and negative affect scores to be .85 and .79, respectively. Support for the temporal stability and internal consistency reliability of test scores from the ACL approaching .90 have been noted (Diener & Emmons, 1984). Further, convergent validity support with extraversion, agreeableness, and social activity has been documented for positive and negative affect scores from the ACL (Coté & Moskowitz, 1998; Reis et al., 2000).

Satisfaction. To capture the cognitive component of HWB, the Satisfaction With Life Scale was used in this study (SWLS; Diener, Emmons, Larsen & Griffin, 1985). The SWLS is a 5-item instrument designed to assess global evaluations life satisfaction. Items such as "The conditions of my life are excellent" were rated on a 5 point Likert scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). Scores were averaged within each participant to have a single score for SWL. Higher scores reflect greater levels of life satisfaction. Support for the validity of the SWLS scores has been documented by Pavot and Diener (2008) with positive associations correlated with extraversion and inverse relationships with neuroticism noted (Diener et al., 1985; Pavot & Diener, 1993). Scores from the SWLS have been associated with other global assessments including, self esteem (Pavot & Diener, 1993). Further evidence of discriminant validity has been noted (Pavot & Diener, 1993) as the SWLS scores were to be uncorrelated with affect intensity and impulsivity. Pavot and Diener (1993) summarized literature supporting estimates of internal consistency resulting from the SWLS scores.

Consistent with DRM literature, episode satisfaction was assessed using White and Dolan's (2009) single item indicator, ''All things considered, how satisfied are you

with this episode?''. Participants responded to this indicator of episode satisfaction on a bipolar rating scale from -3 (*very unsatisfied*) to +3 (*very satisfied*), higher scores reflect greater levels of episode satisfaction.

Eudaimonic Well-being. Global estimates of EWB were assessed through the newly developed Questionnaire for Eudaimonic Well-Being (QEW; Waterman et al., 2010). The 21-item QEW (Sample item: I believe I have discovered who I really am") was on a 5-point Likert-type scale per QEW item, with possible choices ranging from 0 (*strongly disagree*) to 4 (*strongly agree*). Higher scores reflect greater levels of eudaimonic well-being. In their initial validation study, Waterman et al. (2010) demonstrated support for structural, convergent, and divergent validity and estimates of score reliability (coefficient α; Cronbach, 1951) of QEW scores across two samples of university students.

The subscale for Personal Expressiveness (PE; Waterman, 2004) was used to measure eudaimonic well-being for each bout of HEPA across the previous day. This subscale consists of 6-items rated on a 7 point scale with end points anchored 1 (*strongly disagree*) to 7 (*strongly agree*). An example item is "When I engage in this activity I feel more intensely involved than I do when engaged in most other activities". Based on participant responses, an overall average score was tallied with higher scores representing a greater sense of eudaimonia when engaging in that activity. Construct validity has gained support through demonstrating expected patterns of correlations between the subscale for PE and intrinsic motivation (Schwartz & Waterman, 2006), identity styles and ego identity status (Schwartz, Mullis, Waterman, & Dunham, 2000; Waterman, 2004). Test-retest reliability of test scores have been reported (r = 0.82; Waterman,

1991) and estimates of internal consistency (Cronbach α; Cronbach, 1951) ≥ 0.82 (Sharp et al., 2007; Waterman, 1991) reported.

Physical Activity. For global assessments of physical activity, participants completed a modified version of the Godin Leisure Time Exercise Questionnaire (GLTEQ; Godin & Shephard, 1985; Rhodes, Courneya, Blanchard & Plotnikoff, 2007). The GLTEQ asks respondents about the frequency of mild, moderate and strenuous exercise lasting at least 15 minutes per session during a typical week. Instructions directed respondents to indicate the number of times they participated in strenuous (e.g., heart beats rapidly), moderate (e.g., not exhausting) and mild activity (e.g., minimal effort) for at least 15 minutes in an average week. Consistent with work by Rhodes et al. (2007), examples of activities were broad to reflect HEPA activities (i.e., washing dishes, carrying light loads, carrying groceries etc.).

A score estimating metabolic equivalent units (METS) was calculated using the formula [(Mild*3) + (Moderate*5) + (Strenuous*9)] (Godin & Shephard, 1985) with higher scores reflecting higher levels of energy expenditure. Concurrent validity for the GLTEQ has been examined with higher MET estimates demonstrating positive correlations with estimates of cardiorespiratory fitness (i.e., VO_2max) and negative correlations with high body fat scores (Godin & Shephard, 1985). Higher GLTEQ scores have also been associated with higher estimates of energy expenditure derived from activity monitors (r = .45; Miller, Freedson, & Kline, 1994). Estimates of score stability have demonstrated test-retest reliability coefficients ranging from .24 to .96 (Godin & Shephard, 1985; Jacobs, Ainsworth, Hartman, & Leon, 1993; Sallis, Buono, Roby,

Micale, & Nelson, 1993) with minimal influence of social desirability noted with this instrument (Motl, McAuley, & DiStefano, 2005).

Episodic physical activity was measured by gathering information about participant's frequency, duration and effortful engagement (i.e., intensity) in HEPA[1]. Consistent with DRM guidelines (Kahneman et al., 2004), for each HEPA episode from the previous day reported (i.e., frequency), participants were asked to report the day of the week (Monday-Friday; Ryan, Bernstein, & Brown, 2010) start and end times to capture time use data (i.e., duration; Kahneman et al., 2004), and what they were doing (i.e., HEPA; e.g., commuting, structured exercise, etc.; Kahneman et al., 2004). Consistent with Kahneman et al., (2004) and White and Dolan (2009), the sum of episodes reported was used as a marker of frequency of HEPA activities for the day reported, while the sum of minutes within those activities was used as a marker of duration. Consistent with Parisi (2010), a single item indicator was used to assess intensity of each HEPA episode "Please rate the extent to which you had each of these experiences during this activity: Put forth effort" on a Likert scale ranging from 0 (*not at all*) to 6 (*very much*). Higher scores reflect greater levels of effort put forth.

Basic Psychological Needs Satisfaction. The Basic Psychological Needs Satisfaction Scale-General version (BPNS-G) was adapted from the Basic Psychological Needs Satisfaction-Work (Ilardi, Leone, Kasser, & Ryan, 1993). The BPNS-G contains 21 items and measures satisfaction of the three psychological needs namely, competence (6 items), autonomy (7 items), and relatedness (8 items). Participants responded on a Likert scale ranging from 0 (*not true at all*) to 7 (*very true*) regarding how well each psychological need is generally satisfied in their life. Higher scores reflect greater

psychological need satisfaction. An example item is “People in my life care about me”. Past studies have found coefficient alphas ranging from .68 to .90 (Gagné, 2003; Wei, Shaffer, Young, & Zakalik, 2005). Construct validity of BPNS-G scores has been supported through examining the relationships between the three psychological needs and instruments measuring well-being and worry (Johnston & Finney, 2010).

Single item indicators were used to assess psychological need satisfaction during individual HEPA episodes reported (Sheldon & Elliot, 1999). The instructional stem was modified from Sheldon and Elliot’s (1999), "the extent to which you are having each of these three types of experience in your life, at present" to “Please rate the extent to which you had each of these three types of experiences during this activity”. This was to account for the episodic nature of the assessment. The three items were based on the conceptual definitions of the fulfillment of the psychological needs for competence, autonomy, and relatedness offered by Deci and Ryan (1991) and modified slightly to be consistent with study objectives. The competence item was modified from "feeling generally competent and able in what I attempt," to “felt generally competent and able in what I attempted”, the autonomy item was modified from "feeling generally autonomous and choiceful in what I do," to “felt generally autonomous and choiceful in this activity” and the relatedness item was modified from "feeling generally related and connected to the people I spend time with" to “felt generally related and connected to the people I spent time with”. Reponses to each item representing psychological need fulfillment in HEPA contexts ranged from 1 (*very little*) to 7 (*very much*) was used with higher scores reflect greater levels of episodic psychological need satisfaction.

Procedures

This study adopted a correlational, non-probability, non-experimental, cross sectional research design. Following ethical clearance (see Appendix A), participants were recruited through undergraduate Physical Education and Kinesiology courses at Brock University at the discretion of the course instructor. Participants completed the surveys individually or in small-groups in a variety of settings (i.e., a lab, a classroom, or at home). After a brief introduction to the study and procedures, each participant was given informed consent (see Appendix B), a letter of invitation (Appendix C), and a questionnaire package supplied with contact information for inquiries (Appendix D). Participants did not receive academic credit or remuneration of any form for their involvement in this study. After informed consent was obtained, completion of the questionnaires took approximately 45 minutes. Participants were provided with a debriefing form such that they could receive a summary report of the major findings of this study if they wished.

Following the completion of demographic information, participants completed instruments to measure global affect, satisfaction with life, eudaimonic well-being, basic needs satisfaction and leisure time physical activity (LTPA). Upon completion of global indices participants re-constructed a diary of all HEPA episodes on the previous day, ensuring to divide them into a series of personally meaningful episodes (e.g., ‘‘walked to school”). Episodic assessments of HWB, EWB and psychological needs satisfaction were completed for each identified HEPA episode. Designed to reinstate the previous day into working memory (Kahneman et al., 2004), this diary page remained accessible throughout the study as a reference guide with subsequent pages relating to each individual episode.

Data Analysis

Preliminary analysis was conducted in order to identify data entry error, patterns of missing data, and compliance with relevant statistical assumptions. Individual cases were removed from subsequent analysis if all information beyond demographic and global indices was not provided, or the individual indicated no engagement in HEPA on the previous day. Study variables were then screened for missing item responses. For cases with partial missing data (i.e., less than 50% of a scale or subscale), within-person mean substitution was employed. This technique has been recommended by Hawthorne and Elliot (2005) when imputing missing data in cross-sectional research.

Descriptive statistics were calculated on study variables and determination of univariate normality through examination of skewness and kurtosis was undertaken. Estimates of internal consistency (Cronbach's α; Cronbach, 1951) were computed to determine the reliability of global HWB, EWB and BPNS-G scores for satisfaction of each of the three postulated psychological needs. Bivariate correlations were calculated between markers of global and episodic HEPA, hedonic and eudaimonic well-being, and basic psychological needs satisfaction to determine patterns of associations. To further assess the relationship between HEPA and well-being, partial correlations were conducted controlling for global indicators of well-being. Partial correlations were also conducted controlling for global psychological needs satisfaction, to assess the relationships between HEPA and perceived psychological needs satisfaction as well as well-being and perceived psychological needs satisfaction. Confidence intervals (95%) spanning the correlation coefficient were calculated to provide an additional source of information related to null hypothesis significance testing (Thompson, 2001).

As recommended by Preacher and Hayes (2004), multiple mediation of the episodic fulfillment of the three psychological needs within the HEPA-well-being relationship was examined.[2] Preacher and Hayes (2007) bootstrapping procedure (k = 5000 samples) to test multiple mediator models was used. Models were first conducted without covariates to assess whether episodic psychological need satisfaction mediated the HEPA – well-being relationship. Models were then re-analysed statistically controlling for demographic variables and other covariates (i.e., gender, presence of a health condition, day of the week HEPA was recalled, global ratings of psychological need satisfaction, well-being, and LTPA (i.e., GLTEQ scores) and estimates of episodic well-being other than the dependent variable). Statistical control for global-level variables was conducted to allow specific insight into yesterday's HEPA – well-being relationship and the mechanisms (i.e., psychological needs satisfaction) that may offer insight into this relationship.

Bootstrapping is a non-parametric resampling procedure that creates a new sample size based on replacement of cases from the original dataset (Preacher, & Hayes, 2008). The recommended bootstrap sample of 5000 (k = 5000; Preacher & Hayes, 2008) was used for the current analysis. The bootstrapping procedure is superior to conventional causal models (Baron, & Kenny, 1986) or the Sobel test (Sobel, 1982, 1986) because the aforementioned procedures require a normally distributed population and have lower statistical power (Preacher & Hayes, 2008). Bootstrapping produces a 95% bias corrected and accelerated confidence interval (BCa CI; Efron, 1987; Efron & Tibshirani, 1993) that allows an asymmetrical distribution which reduces the potential for Type I error rates. Mediation (or an indirect effect) occurs if the BCa CI does not contain

zero (Preacher & Hayes, 2008). Specific indirect effects were also examined through the use of BCa CIs to examine the contribution of each potential mediator in the model. Preacher and Hayes (2008) recommend testing individual mediators regardless of whether a significant total indirect effect is present. Lastly, pairwise contrasts were conducted to assess the specific indirect effect of psychological needs satisfaction to examine whether perceived psychological needs satisfaction scores, statistically differ from one another.

A series of separate multiple regressions were conducted to clarify which episodic HEPA (i.e., frequency, duration and effort) and psychological needs satisfaction variables had unique predictive effects on which episodic well-being indices. Following Preacher and Hayes (2004), these additional analyses provide information regarding a) the relative magnitude of predictive effects and b) shed light on whether potential instances of a lack of mediation are due to 'insufficient' mediation through the psychological need satisfaction variables, or that some HEPA variables did not predict some of the well-being indicators to begin with. Furthermore, these additional results supplement the bootstrapping results by indicating how large or small (in magnitude) the direct and indirect (mediated) pathways are, before and after accounting for the mediators and covariates. Information about effect magnitude (as conveyed by the individual standardized regression coefficients and model adjusted R^2 values) are also useful to evaluating the practical significance of results. As such, information is provided on standardized and unstandardized beta coefficients for each variable in each model (predictors, covariates), significant *p*-values, adjusted R^2 values and change in R^2 values.

To test unique predictors of each hypothesis, multiple regression models were conducted with various episodic variables treated as simultaneous predictors of each of the various criterion variables (Model A). Regression models were then re-run with the inclusion of the following covariates as predictors: gender, health condition, day of week, three global psychological need satisfaction variables, four global well-being indicators, global GLTEQ, and the three episodic well-being indicators not serving as the criterion in each particular model (Model B). Model A was a multiple regression analyzing the variance accounted for by the primary predictors. Model B was the variance accounted for by the covariates and primary predictor variables. The difference in the R^2 values is what is unique in the models that have covariates as opposed to the variables only.

Results

Preliminary analyses

Individual responses were examined across instruments used to assess study purposes to find missing data. Five (2.45%) of the initial sample had omitted at least one instrument assessing global variables entirely from their responses and one (0.49%) participant did not provide data pertaining to episodes from the previous day. The participant who did not provide episodic data was removed from further analysis. Five (2.46%) participants omitted an episodic single item indicator and were retained to utilize the remainder of their scores. Of the cases retained, participants that provided incomplete data, but had partial responses per subscale/instrument (>50%), were addressed using within-person mean substitution recommended by Hawthorne and Elliot (2005). None of the participants omitted more than one item on a given scale, (i.e., if 5 items for the

subscale and only 4 completed, then within person mean substitution was used for the remaining item).

Sample characteristics

A total (N = 203) of 72 male (M_{age} = 21.10 years; SD_{age} = 1.67 years) and 131 female (M_{age} = 20.47 years; SD_{age} = 2.02 years) university students enrolled in courses at Brock University provided data for this study (see Table 1). Most participants (n = 173; 85.20%) reported some university/college as their highest level of education. The majority of participants were single (n = 196; 97.00%), Caucasian (n = 191; 94.60%) and had not been diagnosed with a chronic disease (n = 179; 88.20%).

Descriptive statistics and estimates of internal consistency

Identifying the number of participants reporting episodes of each mode of HEPA revealed that commuting (30.46%) and leisure activity (29.55%) were the most commonly reported HEPA episodes (see Table 2). Descriptive statistics were calculated for study variables measured at the global level (see Table 3). On average, this sample reported levels of positive affect, SWL, and EWB above the theoretical midpoint of the response scale. On average, negative affect fell below the theoretical midpoint (see Table 3). Participants indicated global fulfillment of the psychological needs for competence, autonomy and relatedness (see Table 3) suggesting that participants perceived their psychological needs were generally fulfilled across life domains. Estimates of internal consistency (Cronbach's α; Cronbach, 1951) were calculated for test scores derived from global well-being and perceived psychological need fulfillment, with α's ranging from .57 to .85 (see Table 4). GLTEQ scores averaged (M_{METS} = 83.00; SD_{METS} = 35.24) per week (see Table 3). Average METS score in the present sample is considerably higher

than normative previously reported (Godin, 2011; Wilson, Mack, Gunnell, Gregson, Cheung, Rimmer, & Sylvester, 2011). However it should be noted that Godin (2011) adopted normative values from moderate and vigorous intensity scores only and scores derived from Wilson et al. (2010) were from leisure-time physical activity (as opposed to HEPA) contexts.

The distributional characteristics of subscale scores observed from episodic data for positive affect, negative affect, satisfaction, personal expressiveness, as well as perceived fulfillment of the psychological needs for competence, autonomy and relatedness can be found in Table 5. With the exception of negative affect, the reported scores were above the theoretical midline of their respective response options (i.e., Likert scales). Responses to items comprising negative affect fell below the midpoint. Results of well-being and psychological need satisfaction variables revealed some deviation from normality (skewness ranged from -1.56 to 1.15 and kurtosis ranged from -0.42 to 3.37; Glass & Hopkins, 1996; see Table 5). Episode satisfaction and perceived competence were both found to be leptokurtotic (3.37; and 3.36; respectively; Table 5). Estimates of reliability (Cronbach's α; Cronbach, 1951) were calculated from episodic scores with multiple-item indicators with α's ranging from 0.74 to 0.97 (see Table 6).

The descriptive information concerning participant's HEPA on the previous day was calculated. Participants engaged in approximately 3 episodes of HEPA for 10 minutes or more across the previous day. Participants, on average reported engaging in 202.10 minutes of HEPA across the previous day with average effort values reported above the theoretical midpoint (see Table 5). Correlations between global and episodic-

level variables are presented in Table 7 with a general pattern of small positive relationships found.

Preliminary Findings

Global Level Variables. Pearson bivariate correlations were calculated between all global indices of hedonic and eudaimonic well-being and psychological need satisfaction variables (see Table 4). A pattern of weak-to-moderate positive correlations were found between global indices of hedonic and eudaimonic well-being (r_{12}*'s* ranged from -.05 to .56). A positive association was observed between positive affect, satisfaction with life, and EWB scores. Negative affect consistently demonstrated a pattern of negative association with positive affect, satisfaction with life and EWB though none of the relationships reached statistical significance ($p > .05$). A pattern of moderate positive correlations between global indices of perceived psychological needs satisfaction was also found (r_{12}*'s* ranged from .57 to .66; see Table 4).

The pattern of associations between global markers of perceived psychological needs satisfaction and well-being, were observed to be small-to-moderate and positive in this sample. Greater perceived psychological need fulfillment was associated with greater well-being across three positive markers (positive affect, satisfaction with life and eudaimonia; r_{12}*'s* ranged from .34 to .63; see Table 4). When negative affect served as the marker of well-being, greater psychological need fulfillment was associated with lower scores (r_{12}'s ranged from -.20 to -.25). The magnitude of the bivariate correlations demonstrated perceived competence was moderate and positive with positive affect (r_{12} = .61), satisfaction with life (r_{12} = .51), and eudaimonia (r_{12} = .63), and perceived satisfaction of the psychological needs for autonomy and relatedness was small-moderate and positive (r_{12}'s ranged from -.20 to .49). Global autonomy was shown to have a small

negative relationship to negative affect (r_{12} = -.25), and a small relationship with eudaimonia (r_{12} = .37). Social connections to others had a weak negative relationship to negative affect (r_{12} = -.20) and satisfaction with life (r_{12} = .47; see Table 4).

Episodic-Level Variables. Pearson bivariate correlations were also calculated between all episodic indices of HWB and EWB and psychological need satisfaction variables (see Table 6). Moderate, positive correlations were found between indices of positive affect, satisfaction and personal expressiveness (r_{12}*'s* ranged from .61 to .63). As hypothesized, greater negative affect was associated lower positive affect (r_{12} = -.22) and satisfaction (r_{12} = -.28). While in the hypothesized direction, negative affect was not significantly related to personal expressiveness (r_{12} = -.06). A pattern of moderate-to-strong positive correlations between episodic indices of perceived psychological needs satisfaction were found (r_{12}*'s* ranged from .43 to .74; see Table 6).

Relationships between Global and Episodic Well-Being Markers. Small positive relationships were noted between all global well-being markers and their episodic counterpart (see Table 7). More specifically, when bivariate analyses were assessed for global positive affect – episodic positive affect a small positive relationship was noted (r_{12} = .23). A similar pattern of results was found for negative affect (r_{12} = .28), satisfaction with life (r_{12} = .13) and EWB (r_{12} = .23). All relationships between corresponding markers of global and episodic well-being were meaningful (except satisfaction with life and satisfaction with episode) according to 95% confidence intervals. Patterns of association between global and episodic indices of psychological need satisfaction were not significant ($r_{12\ autonomy}$ = .01 to $r_{12\ relatedness}$ = .12; see Table 7). Correlations between global and episodic HEPA markers showed statistical significance

with most variables (based on 95% confidence intervals) as the GLTEQ correlated significantly with HEPA-Frequency (r_{12} = .23) and HEPA- Duration (r_{12} = .21) and was not significantly related to HEPA-Effort (r_{12} = .06; see Table 7).

Main Findings

Associations between HEPA and Well-Being. When episodic HEPA was defined as the number of episodes on the previous day (frequency), interpretation of bivariate correlations, (*p*-values and confidence intervals) demonstrated no association with indices of episodic well-being or psychological need satisfaction (see Table 6). Episodic indices revealed a pattern of small positive correlations between total time of episodes (HEPA-Duration) and positive affect (r_{12} =.20) satisfaction (r_{12} = .18) and personal expressiveness (r_{12} = .23; see Table 6). HEPA-Effort showed statistically significant, moderate positive relationships with positive affect (r_{12} = .51), satisfaction (r_{12} = .46) and personal expressiveness (r_{12} = .62; see Table 6). Negative affect was not associated with either duration or effort of HEPA engaged in across the previous day.

Similar conclusions emerged after statistically controlling for global indicators of well-being and LTPA, as two of the three episodic HEPA indicators demonstrated a statistically meaningful relationship to well-being (see Table 8). HEPA-Duration and HEPA-Effort were significantly related to positive affect ($r_{12.3}$ = .13; and $r_{12.3}$ = .44; respectively) and personal expressiveness ($r_{12.3}$ = .17; and $r_{12.3}$ = .59; respectively). HEPA-Effort was also statistically meaningful in relation to satisfaction ($r_{12.3}$ = .43; see Table 8). No relationships between indices of HEPA and negative affect were statistically meaningful.

Multiple regressions showed that indices of HEPA predicted positive affect ($R^2_{adj.}$ = 0.22), satisfaction ($R^2_{adj.}$ = 0.21), and personal expressiveness ($R^2_{adj.}$ = 0.37) in Model A (see Table 19). Interpretation of the standardized beta coefficients revealed that HEPA-Effort was the only HEPA variable that was a statistically significant predictor of positive affect (β = 0.46), satisfaction (β = 0.21), or personal expressiveness (β = 0.59). With the inclusion of covariates (Model B) no HEPA variable predicted positive affect, but HEPA-Effort remained a statistically significant predictor of satisfaction (β = 0.24), personal expressiveness (β = 0.38), and negative affect (β = 0.21). Values of ΔR^2 revealed that when HEPA variables were included with covariates, episodic HEPA-Effort still uniquely predicted satisfaction (ΔR^2 = 0.04) and personal expressiveness (ΔR^2 = 0.11; see Table 19).

Associations between HEPA and Psychological Needs Satisfaction. Bivariate correlations demonstrated no association between indices of HEPA-Frequency and episodic psychological need satisfaction (see Table 6). Episodic indices revealed a pattern of small positive correlations between total time of episodes (i.e., HEPA-Duration) and perceived competence (r_{12} =.20) and relatedness (r_{12} = .17; see Table 6). HEPA-Effort showed statistically significant, small positive relationships with perceived competence (r_{12} = .36), autonomy (r_{12} = .35) and relatedness (r_{12} = .33; see Table 6).

After statistically controlling for global indicators of psychological needs satisfaction, partial correlations and 95% confidence intervals demonstrated significant relationships between markers of HEPA and psychological needs satisfaction. Specifically, HEPA-Duration was associated with the fulfilment of competence ($r_{12.3}$ = .18) and HEPA-Effort showed meaningful relationships with psychological need

satisfaction of competence ($r_{12.3}$ = .27), autonomy ($r_{12.3}$ = .27) and relatedness ($r_{12.3}$ = .26; see Table 9).

Multiple regressions showed that indices of HEPA predicted satisfaction of the psychological needs for competence ($R^2_{adj.}$ = 0.10), autonomy ($R^2_{adj.}$ = 0.09), and relatedness ($R^2_{adj.}$ = 0.09) in Model A (see Table 20). HEPA-Effort was the only HEPA variable that was a statistically significant predictor of perceived fulfillment of the psychological needs for competence (β = 0.29), autonomy (β = 0.32), or relatedness (β = 0.26). With the inclusion of episodic HEPA variables to covariates (Model B), HEPA still predicted psychological need satisfaction. HEPA-Effort remained the only statistically significant predictor of perceived satisfaction of competence (β = 0.25), autonomy (β = 0.29), and relatedness (β = 0.23) while ΔR^2 values revealed that episodic HEPA-Effort still uniquely predicted psychological need satisfaction of competence (ΔR^2 = 0.09), autonomy (ΔR^2 = 0.08), and relatedness (ΔR^2 = 0.08) even after inclusion of the covariates (see Table 20).

Associations between Psychological Needs Satisfaction and Well-Being. When examined episodically, bivariate patterns of association between perceived psychological needs satisfaction and well-being demonstrated a pattern of small-to-moderate positive correlations (see Table 6). Greater perceived psychological need fulfillment was associated with greater well-being across positive affect, satisfaction and personal expressiveness (episodic r_{12}*'s* ranged from .27 to .61) and lower negative affect (r_{12}'s ranged from -.07 to -.11). Perceived competence and autonomy were positively related to affective markers of well-being (see Table 6). Episodic autonomy demonstrated a moderate positive relationship with positive affect and the highest

magnitude of correlation with satisfaction. Finally, episodic fulfillment of the psychological need for relatedness in HEPA contexts had the weakest relationship with negative affect and the strongest relationship with personal expressiveness (see Table 6) in comparison to satisfaction of the other basic psychological needs. The 95% confidence interval spanned zero when the associations between psychological need fulfillment and negative affect were considered. Similar results were noted after statistically controlling for global markers of well-being and psychological needs satisfaction (see Table 10).

Results from the multiple regressions revealed that episodic psychological needs satisfaction predicted positive affect ($R^2_{adj.} = 0.48$), satisfaction ($R^2_{adj.} = 0.13$), and personal expressiveness ($R^2_{adj.} = 0.18$) in Model A (see Table 21). Interpretation of the standardized beta coefficients demonstrated that perceived competence uniquely predicted positive affect ($\beta = 0.26$), autonomy predicted positive affect ($\beta = 0.27$), and satisfaction ($\beta = 0.27$), and relatedness uniquely predicted positive affect ($\beta = 0.31$), and personal expressiveness ($\beta = 0.30$). Negative affect was not predicted by any of the psychological need satisfaction variables.

With the inclusion of episodic psychological need satisfaction variables to the covariates (Model B), fulfillment of all three psychological needs remained uniquely predictive of positive affect, but did not predict negative affect, or satisfaction. The only psychological need satisfaction variable that uniquely predicted personal expressiveness was relatedness ($\beta = 0.13$). Interpretation of ΔR^2 values revealed that the only index of well-being that had additional statistically significant variance accounted for after adding

episodic psychological need satisfaction to the covariate models was positive affect (ΔR^2 = 0.18; see Table 21).

Fulfillment of Psychological Needs as Mediators in the HEPA-Well-Being Relationship: No Covariates

Hedonic well-being.

Positive affect. Examination of results derived from the bootstrapping procedure to test for multiple mediation indicated that HEPA- Frequency and episodic positive affect ($R^2adj.$ = 0.44; $p < 0.001$) was not mediated by the fulfillment of competence, autonomy and relatedness with a point estimate of -0.0086 and BCa CI = -0.0887 to 0.0782 (see Table 11). HEPA-Duration and episodic positive affect revealed that the model ($R^2adj.$ = 0.49; $p < .001$) was mediated by the fulfillment of the three psychological needs (point estimate = 0.0012; BCa CI = 0.0004 to 0.0024; see Table 11). Perceived competence and relatedness emerged as statistically meaningful indirect effects in the model (point estimate = 0.0005; BCa CI = 0.0001 to 0.0011; and point estimate = 0.0005; BCa CI = 0.0001 to 0.0010; respectively). The relationship between HEPA-Effort and episodic positive affect revealed ($R^2adj.$ = 0.54; $p < .001$), that the model was mediated by the fulfillment of the three psychological needs (point estimate = 0.2206; BCa CI = 0.1226 to 0.3634; see Table 11). Further analysis revealed that perceived autonomy and relatedness emerged as statistically meaningful indirect effects in the model (point estimate = 0.0721; BCa CI = 0.0267 to 0.1439; and point estimate = 0.0733; BCa CI = 0.0276 to 0.1406 respectively; see Table 11). Interpretation of the pairwise contrasts suggests that no individual psychological need satisfaction variable was

statistically different from another indicating that differences seen during mediation analyses do not imply differences between constructs, simply patterns in the data.

Negative Affect. Multiple mediation between HEPA-Frequency and episodic negative affect demonstrated ($R^2adj.$ = 0.03; $p < 0.05$) no mediation through the fulfillment of competence, autonomy or relatedness with a point estimate of 0.0020 and BCa CI = -0.0159 to 0.0221 (see Table 12). HEPA-Duration and negative affect revealed that the model of the relationship ($R^2adj.$ = -0.01; $p > .05$) was not mediated by the fulfillment of the three perceived psychological needs (point estimate = -0.0001; BCa CI = -0.0005 to 0.0001; see Table 12). Further analysis revealed no statistically meaningful indirect effects in contributors to the model. When analyzing the relationship between HEPA-Effort and negative affect ($R^2adj.$ = -0.00; $p > .05$), the model was not mediated by the fulfillment of the three psychological needs (point estimate = -0.0244; BCa CI = -0.0623 to 0.0209) and there were no statistically meaningful indirect effects in the model (see Table 12).

Satisfaction. HEPA-Frequency and episode satisfaction ($R^2adj.$ = 0.12; $p <$ 0.001; point estimate of -0.0002 and BCa CI = -0.0441 to 0.0499) and HEPA-Duration ($R^2adj.$ = 0.14; $p < .001$; point estimate = 0.0004; BCa CI = -0.0001 to 0.0009; see Table 13) were not mediated by perceived fulfillment of the psychological needs. Multiple mediation was evident when HEPA-Effort was the predictor variable ($R^2adj.$ = 0.24; $p <$ .001; point estimate = 0.0634; BCa CI = 0.0163 to 0.1206; see Table 13). Interpretation of indirect effects and pairwise contrasts suggested that no perceived psychological needs showed statistically meaningful indirect effects in the model and were not statistically different from each other.

Personal Expressiveness. Finally, the relationship between HEPA-Frequency and episodic personal expressiveness revealed that the model ($R^2adj.$ = 0.14; $p < .001$) was not mediated by the fulfillment of the three perceived psychological needs (point estimate = -0.0076; BCa CI = -0.0630 to 0.0543; see Table 14). No perceived psychological needs satisfaction variables had statistically meaningful indirect effects in the model. When duration of HEPA across the previous day served as the independent variable, the fulfillment of the three psychological needs mediated the model ($R^2adj.$ = 0.19; $p < .001$; point estimate = 0.0008; BCa CI = 0.0002 to 0.0017; see Table 14). Perceived satisfaction of the psychological needs for autonomy and relatedness emerged as statistically meaningful indirect effects in the model (point estimate = 0.0002; BCa CI = 0.0000 to 0.0007; and point estimate = 0.0005; BCa CI = 0.0001 to 0.0012; respectively). When analyzing the relationship between HEPA-Effort and episodic personal expressiveness, the model ($R^2adj.$ = 0.42; $p < .001$) was mediated by the fulfillment of the three psychological needs (point estimate = 0.0824; BCa CI = 0.0269 to 0.1601; see Table 14). Indirect effects revealed that perceived satisfaction of the psychological need for relatedness emerged as the only contributor to the model (point estimate = 0.0553; BCa CI = 0.0144 to 0.1219). Consideration of pairwise contrasts did not suggest statistical differences between perceived psychological need satisfaction variables.

Fulfillment of Psychological Needs as Mediators in the HEPA-Well-Being Relationship: With Covariates

Multiple mediation results between HEPA and well-being while statistically controlling for select covariates (i.e., gender, day of the week HEPA was reported for,

health status, global reports of psychological need satisfaction, well-being, and LTPA, as well as episodic well-being variables other than the dependent variable) revealed that no overall models had meaningful relationships. Consistent with Preacher and Hayes (2008), subsequent analyses revealed that the only statistically meaningful indirect effect was competence when testing HEPA-Duration and positive affect (point estimate = .0003; BCa CI = .0001 - .0008; see Table 15).

Statistically Independent Effects

Episodic HEPA and psychological need satisfaction variables were assessed simultaneously through a series of multiple regression analyses (see Table 22; Model A) to determine statistically independent relationships of each variable with episodic well-being. Positive affect was predicted by the primary predictors ($R^2_{adj.} = 0.48$) which beta coefficients revealed to be uniquely predicted by HEPA-Effort ($\beta = .26$), and fulfillment of competence ($\beta = .22$), autonomy ($\beta = .21$), and relatedness ($\beta = .26$). Furthermore, satisfaction ($R^2_{adj.} = 0.24$) and personal expressiveness ($R^2_{adj.} = 0.40$) were also predicted overall by episodic HEPA and psychological needs satisfaction. When beta coefficients were considered, only HEPA-Effort predicted episodic satisfaction and personal expressiveness ($\beta = .39$; $\beta = .52$, respectively). Negative affect was not predicted by any episodic HEPA or episodic psychological need satisfaction variable in Model A (see Table 22).

With the simultaneous inclusion of episodic HEPA and psychological need satisfaction variables to the covariates (Model B), the model predicting positive affect remained statistically significant ($R^2_{adj.} = 0.66$; $\Delta R^2 = 0.15$). Fulfillment of all three psychological needs remained uniquely predictive of positive affect, but HEPA-Effort did

not. In addition to the covariates (Model B), the inclusion of episodic HEPA and psychological needs satisfaction accounted for additional variance in satisfaction ($R^2_{adj.}$ = 0.46; ΔR^2 = 0.04) and personal expressiveness ($R^2_{adj.}$ = 0.59; ΔR^2 = 0.12). Analyses of beta coefficients revealed that HEPA-Effort was the most consistent unique predictor of well-being and more strongly predictive of personal expressiveness (β = .52) than any index of HWB. Model B demonstrated that psychological needs satisfaction did not account for additional variance of negative affect, satisfaction or personal expressiveness (see Table 22). Further, comparison of Model B results between Table 19 (episodic HEPA plus covariates) and Table 22 (episodic HEPA and psychological need satisfaction, plus covariates) revealed that the standardized beta coefficients for episodic HEPA-Effort and HEPA-Duration in predicting negative affect, satisfaction and personal expressiveness were unchanged- indicating that in these models the predictive effects of episodic HEPA-Effort were *not* mediated by episodic psychological need satisfaction.

Discussion

The first objective of the present study was to examine the relationship between HEPA and well-being when both constructs are assessed based on experiences from the previous day (i.e., at the level of the episode). A secondary objective was to examine the role of episodic psychological need satisfaction as a mediator of the episodic HEPA – well-being relationship.

Furthermore, it was hypothesized that episodic HEPA would be positively associated with hedonic and eudaimonic well-being across the previous day and that that the pattern of relationships between HEPA and well-being as assessed across the previous day would hold after statistically controlling for global indicators of each (Kahneman & Riis, 2005).

Additionally, episodic fulfillment of the psychological needs for competence, autonomy, and relatedness would demonstrate a pattern of small-to-moderate positive associations with episodic HEPA (Wilson et al., 2006; Wilson et al., 2008; Wilson et al., 2009). Furthermore, a positive relationship between episodic psychological need satisfaction and well-being in episodic HEPA contexts was also hypothesized. Finally, based on SDT (Deci & Ryan, 1985; 2002) and previous research (Gunnell et al., in press; Mack et al., under review; Vallerand & Losier, 1999; Vallerand & Ratelle, 2002), it was hypothesized that episodic perceived psychological need satisfaction would mediate the episodic HEPA-well-being relationship.

Key findings suggested that depending which aspects of HEPA and well-being were being assessed, the relationship between episodic HEPA and well-being was small-moderate and positive. Secondly, psychological needs satisfaction mediated the episodic HEPA-positive affect relationship, but when HEPA variables were examined separately the relationship between episodic HEPA and negative affect, satisfaction, and personal expressiveness was *not* mediated by episodic psychological needs satisfaction.

Examining the relationship between HEPA and Well-Being

To test the relationship between HEPA and well-being, bivariate and partial correlations were conducted, as well as multiple regressions. Based on the magnitude of bivariate correlations in the present study, episodic levels of hedonic (i.e., positive affect) and eudaimonic well-being (i.e., personal expressiveness) were more strongly associated to HEPA than global measures of well-being were associated with LTPA. Further, conclusions emanating from the DRM literature (e.g., Kahneman et al., 2004; White & Dolan, 2009) have demonstrated the relative importance of physical activity on well-

being in comparison to many other activities engaged in through the day (e.g., socializing, using the internet etc.,). This is in contrast to the comparably smaller relationships between physical activity and global markers of well-being noted in the literature (Blacklock et al., 2007).

Consistent with previous literature in physical activity contexts, HEPA was positively related to HWB and EWB (Brassai et al., 2011; Edwards et al., 2005; Fox, 2002; Netz et al., 2005), even after statistically controlling for global indicators of well-being and LTPA. The only index of well-being that became non-significant after statistically controlling for global markers was satisfaction with the HEPA episode. Satisfaction with episode, albeit a single item (Diener, et al., 2009; Helliwell & Barrington-Leigh, 2010), was the only cognitively appraised aspect of well-being as the remainder (positive affect, negative affect and personal expressiveness) were all based on affective assessments of well-being. Diener (1984) commented on the theoretical importance of distinguishing between the cognitive and affective components of HWB with subsequent research demonstrating different predictors (Helliwell & Barrington-Leigh, 2010; Jovanovic, 2011). Episodic HEPA was more associated with affective conceptualizations of well-being (i.e., positive affect) as opposed to cognitive appraisals (i.e., satisfaction). Evidence suggests that cognitions are more stable than affect (de Haes, Pennink, & Welvaart, 1987) yet implications of current findings suggest that both affective and cognitive appraisals across the previous day were associated with higher scores of well-being. As affect changes more frequently than cognitive assessments (Diener et al., 2009), understanding the relationship between episodic HEPA and well-being may be more (or less) sensitive over the course of a single day.

Bivariate correlations of global and episodic markers were assessed to provide information specific to the patterns of association and the first research objective. Patterns of association are important to assess because they provide insight regarding the direction and magnitude of study variables while also establishing grounds to assess mediation (Preacher & Hayes, 2004). Global indices had small positive relationships between LTPA and aspects of well-being (positive affect and satisfaction with life). Episodic results demonstrated small to moderate positive relationships between aspects of HEPA, and well-being (with the exception of negative affect). Both global and episodic findings were in the expected direction as past literature which has used various operational definitions of physical activity and well-being (Biddle et al., 2000; Fox, 2002; Gunnell et al., in press; White & Dolan, 2009) including HEPA (Cerin et al., 2009) and has shown similar relationships with positive affect. As a consequence, the generally endorsed association between physical activity and well-being may extend to HEPA and may be generalized to episodic levels of measurement.

Findings add insight to Warburton et al. (2007) who suggested that the relationship between satisfaction with life and physical activity is not yet fully understood in healthy adult samples. This study demonstrated a small positive relationship between satisfaction with life and LTPA, suggesting that knowing ones satisfaction with life or global levels of LTPA provides insight to the other respective construct.

Differential findings emerged when considering the relationship between physical activity and eudaimonic well-being. Results garnered at the global level were not significant which is contradictory to findings that used other conceptualizations of eudaimonia (e.g., subjective vitality; Gunnell et al., 2009). However, episodic HEPA

variables across the previous day (i.e., duration and effort) were associated ($p < .05$). It should be noted however, that different measures were used to assess the relationship at the global (i.e., LTEQ and QEW) and episodic level (i.e., HEPA and personal expressiveness) which may contribute to the noted inconsistencies. Further, reliability estimates (coefficient α; Cronbach, 1951) of scores from the QEW (Waterman et al., 2010) may have compromised the ability of the test to yield meaningful effects (e.g., attenuate effect sizes; Thompson, 2003). Findings suggest that a meaningful relationship between physical activity and eudaimonic well-being may depend on the level of measurement as well as the conceptualization and operationalization of each construct.

With the three episodic HEPA variables (i.e., frequency, duration and effort) simultaneously predicting positive affect, satisfaction and personal expressiveness, HEPA-Effort was the only unique predictor of these relationships. Furthermore, HEPA-Effort was the only unique predictor even when rigorous statistical independence was analyzed (see Table 19; Model B). These findings support the relationship between HEPA and well-being and are in line with Lyubomirsky et al. (2005) who suggested that the portion of well-being within our control may be modified through intentional activities in which one puts forth effort. This study extends findings from Lyubomirsky et al. (2005) as it provides evidence for the unique association between effort and well-being in HEPA contexts. Future research should examine this relationship with different statistical controls, conceptualizations (i.e., LTPA), samples, and study designs (e.g., using an experimental study to see if manipulated increases in HEPA effort results in increases in well-being) to further explore the potential relationship between effort and well-being.

HEPA and Basic Psychological Needs Satisfaction

Concerning the second study objective, the psychological needs for competence, autonomy, and relatedness demonstrated a pattern of small positive associations with HEPA. Deci and Ryan (2002) have argued that psychological need satisfaction is universal and innate. However, the ways in which the three psychological are satisfied may differ across contexts (Ryan & Deci, 2000). Existing research has reported greater satisfaction of perceived competence and autonomy than relatedness in exercise contexts (Edmunds et al., 2007; Peddle et al., 2007; Wilson et al., 2006; 2008; 2009) and has consistently found a relationship between psychological need satisfaction and behaviour at an episodic level of measurement (i.e., Reis et al., 2000). A relationship between psychological need satisfaction and HEPA at an episodic level of measurement (to our knowledge) was assessed for the first time. Current findings are consistent with Wilson and Muon (2008), who examined LTPA and psychological need satisfaction in healthy university students and also found small associations between physical activity and perceived competence, autonomy and relatedness.

Bivariate and partial correlations (statistically controlling for global indices of LTPA and psychological need satisfaction) and multiple regressions in the present investigation showed that the number of episodes (i.e., frequency) was not related (95% CI spanned 0; $p < .05$) with psychological need satisfaction. This finding was similar to Edmunds and colleagues (2007) who found competence and autonomy to have no relationship with frequency of physical activity participation. The contradiction that relatedness was associated with frequency of physical activity in Edmunds et al. (2007) and not in the current study warrants further research to test this relationship. Possible

explanations for this contradiction are the difference in research design, (i.e., experimental versus cross sectional) as well as the instruments used (e.g., LTEQ versus HEPA) and level of measurement employed (i.e., global versus episodic). In the current study, bivariate and partial correlations of perceived fulfillment of competence and relatedness in HEPA contexts was associated with both duration and effort, with perceptions that HEPA is engaged in volitionally and under one's control (i.e., autonomy) associated only with effort. One possible explanation for this finding is the ability for internal control and assessment of effort (compared to frequency and duration). HEPA incorporates activities that one may feel pressured, compelled, or less autonomous to participate in (i.e., frequency and duration of commuting, household chores, etc.) and perhaps participants felt more autonomous during leisure HEPA activities.

Interpretation of multiple regression results indicate that once episodic HEPA and psychological need satisfaction variables were statistically controlled, the only unique predictor was HEPA-Effort across all psychological need satisfaction variables. Findings add to literature which has found mixed results concerning the fulfillment of the psychological need for relatedness through exercise, by providing information on whether or not perceived relatedness is associated with an episodic assessment of HEPA (Wilson et al., 2009). Finally, the contribution of psychological need satisfaction varied depending on the HEPA variables assessed, a finding which holds empirical and practical promise for health promotion specialists who may wish to focus on increasing effort of HEPA since effort was uniquely associated with greater levels of all basic psychological need satisfaction variables. This study provides novel insight into the different aspects of HEPA (i.e., frequency, duration and effort) and their relationship with episodic

psychological need satisfaction variables. This is important for future research to understand what aspects of episodic HEPA are associated with episodic psychological need satisfaction to try to understand the experience.

Basic Psychological Needs Satisfaction and Well-Being

Deci and Ryan (2002) advocate that psychological needs satisfaction is necessary for on-going psychological growth and well-being, indicating that they help us understand variation in positive dimensions of well-being (e.g., positive affect), as opposed to variation present in the absence of well-being (e.g., negative affect; Lightheart, Wilson, & Oster, 2010; Sheldon & Bettencourt, 2002). Empirical research supports this notion as the perceived fulfillment of psychological needs has demonstrated stronger links with markers of well-being than ill-being (e.g., Adie et al., 2008; Mack et al., 2011; Quested & Duda, 2010; Smith et al., 2010). Consistent with this argument, stronger relationships were found between markers of positive well-being than the absence of negative affect. Global negative affect showed small significant negative relationships with psychological need satisfaction, however when assessed across the previous day, negative affect showed no significant relationship with measures of psychological needs. More specifically, current results of bivariate and partial correlations found competence and autonomy were moderately related to positive affect and showed small-moderate, positive relationships with satisfaction and personal expressiveness while relatedness showed small-moderate positive relationships with all well-being indices except negative affect. One possible reason for the difference in magnitude may be because satisfaction of the psychological needs for competence and autonomy is more prominent in HEPA contexts. Multiple regression analyses

demonstrated that when satisfaction of the psychological needs was added to the variance already accounted for by covariates, the only index of well-being they each significantly predicted was positive affect. This has theoretical implications as Deci and Ryan (2002) contend that psychological need satisfaction should directly relate to well-being (i.e., eudaimonic well-being), which was not supported upon examination of the independent effects.

Consistent with numerous studies that have linked fulfillment of psychological needs through physical activity contexts with well-being indices (i.e., Edmunds et al., 2007; Gagné et al., 2003; Gunnell et al., in press; Mack et al., 2011; Peddle et al., 2007; Wilson et al., 2008), bivariate and partial correlations showed significant relationships between constructs embedded within BPNT (Deci & Ryan, 2002) and well-being. Bivariate correlations also demonstrated that psychological need satisfaction was associated with the promotion of well-being and had a more variable association with the absence of well-being. Deci and Ryan (2002) suggest that psychological need fulfillment is linked with eudaimonic (e.g., personal expressiveness) more so than hedonic (e.g., positive affect) well-being, yet this argument has been infrequently examined in HEPA literature. Current findings did not support this idea as bivariate correlations found that psychological need satisfaction had stronger magnitudes of correlation with positive affect and negligible differences between episode satisfaction and personal expressiveness.

Multiple regression analyses took the bivariate and partial correlation findings one step further, demonstrating that satisfaction of each of the psychological needs may be more or less uniquely predictive depending on the index of well-being serving as the

criterion. Satisfaction of all three psychological needs were unique predictors of positive affect, autonomy was the only unique predictor of satisfaction and relatedness was the only unique predictor of personal expressiveness (see Table 21). These findings were similar to Wilson and Bengeochia (2010) who also found competence and relatedness to uniquely predict positive affect and an alternative measure of eudaimonia (namely subjective vitality). These findings suggest that perhaps psychological needs satisfaction does not predict all indices of well-being in HEPA contexts. Much of the variance accounted for by the satisfaction of the psychological needs was shared with other indices of episodic well-being (see Table 21) and HEPA-Effort (see Table 22). Autonomy was related to satisfaction, and relatedness was related to personal expressiveness (i.e., eudaimonic well-being). Perhaps statistical relationships between psychological need satisfaction and well-being exist because fulfillment of each psychological need accounts for variance in different indices of well-being.

Findings provide an episodic assessment which demonstrates that in HEPA contexts experienced yesterday, psychological needs satisfaction was related to indices of well-being (positive affect, satisfaction and personal expressiveness) and did not demonstrate a relationship to the absence of well-being (i.e., negative affect). Furthermore, this study also provides analyses demonstrating relationships between variables with statistical independence from each other. Future research should further explore if psychological needs satisfaction and well-being are uniquely associated through specific psychological needs satisfaction variables and indices of well-being.

Psychological Needs Satisfaction as Mediators of the HEPA – Well-Being Relationship

Researchers have advocated for heightened understanding of the mechanisms underpinning the physical activity – well-being relationship (Cerin, 2010) including the extent to which psychological need satisfaction variables serve as mediators (Gunnell et al., in press; Vallerand & Losier, 1999; Vallerand & Ratelle, 2002). Greater scores of psychological needs satisfaction in HEPA contexts were associated with greater scores of well-being which supports BPNT (Deci & Ryan, 2002) tenets while interpretation of pairwise contrasts showed no unique differences. This lack of difference in pairwise contrasts supports the idea that the three psychological need satisfaction variables are evenly scored and implies that differences in relationships are a result of patterns in the data. The above held when the duration or effort of HEPA was considered as opposed to frequency across the previous day. Consequently, further support for BPNT (Deci & Ryan, 2002) tenets in applied contexts (i.e., HEPA) is offered. Interpretation of the indirect effects within the mediation analyses suggests that satisfaction of only specific psychological needs may be statistically meaningful when considering the HEPA – well-being relationship. This could be a result of how we experience different aspects of HEPA, perhaps different psychological needs are satisfied by certain aspects of the HEPA experience.

When positive affect was the criterion variable, statistically meaningful indirect effects for HEPA-Duration, were found through perceptions of competence and relatedness, with perceptions of a meaningful connection to others retaining its influence when effort was considered. Consistent with past literature (Wilson et al., 2008), competence partially accounted for the relationship between HEPA and positive affect. This finding is consistent with the conceptualization of competence as it is characterized

by positive feelings of being effective in one's social environment (White, 1959; Deci & Ryan, 2002). Psychological need satisfaction did not mediate the HEPA – negative affect relationship which lends further credence to Deci and Ryan's (2002) contention that psychological needs satisfaction explains variation in positive dimensions of well-being (e.g., positive affect), but not variation in the absence of well-being (e.g., negative affect).

Psychological needs satisfaction between HEPA-Duration and Satisfaction was not collectively mediated and none of the psychological needs satisfaction variables showed statistically meaningful indirect effects. However, psychological needs satisfaction emerged as mediators of the HEPA-Satisfaction relationship when effort was assessed though no unique effects were found. This finding further supports Lyubomirsky et al. (2005) that effortful engagement of intentional activities is associated with well-being. This finding provides mixed support for Deci and Ryan's (2002) contentions as collectively, the psychological needs satisfaction variables only statistically mediated the HEPA- Satisfaction relationship when effort was used as the index of HEPA. This finding could potentially be useful for the promotion of HEPA or well-being by focusing on psychological needs satisfaction through effort. Obviously further research is warranted to explore this relationship.

The HEPA – personal expressiveness relationship was statistically mediated by indirect effects of perceived fulfillment for autonomy and relatedness when duration of HEPA was considered, with relatedness (again) a statistically meaningful indirect effect to the effort – EWB relationship. Mack et al. (under review) also found that perceived autonomy and relatedness had statistically meaningful indirect effects in mediating the relationship between change in HEPA across a six month period and markers of EWB.

Support for autonomy as an essential psychological need for well-being has been identified by Deci and Ryan (2000). Futhermore, Ryan and Deci (2001) argued for the importance of psychological need satisfaction for understanding variation in eudaimonic (as opposed to hedonic) well-being. Contrary to Gunnell et al. (in press) who showed competence as an indirect effect in a less active, osteoporotic sample, relatedness was the most consistent indirect effect of the mediation models revealing an effect on the relationships between both duration and effort on both positive affect, and personal expressiveness. Another possible explanation for this difference between Gunnell et al. (in press) and the current study was the operational definitions of physical activity (i.e., LTEQ) and eudaimonic well-being (i.e., vitality). Finding relatedness as the most consistent mediator was not surprising given the available evidence on the importance of social relationships, (e.g., family, friends, intimate relationships, etc.) to enhancing one's psychological experiences (e.g., relatedness; Baumeister & Leary, 1995; Ryff & Singer, 2000; Diener & Seligman, 2002).

When covariates (i.e., gender, day of the week HEPA was reported for, health status, global reports of psychological need satisfaction, well-being, and LTPA, as well as episodic well-being variables other than the dependent variable) were statistically controlled for, multiple mediation results between HEPA and well-being revealed that no overall models had meaningful relationships. The only statistically meaningful indirect effect was found through competence when testing HEPA-Duration and positive affect. This finding suggests that at an episodic level the relationship between HEPA and well-being does not matter once certain variables are statistically controlled for. Findings from multiple regression results (discussed later) break down this finding even further.

Overall the indirect effects of this mediation analyses demonstrate that psychological needs satisfaction statistically mediated the episodic relationship between HEPA and well-being depending on the operational definition of each. Specifically, this study provides support for the association between effort and all indices of well-being (except negative affect) and duration with affective evaluations of well-being. Satisfaction of the psychological need for relatedness in the episodic HEPA-well-being relationship was the most consistent statistically meaningful indirect effect, suggesting a potential mechanism of this relationship. The promotion of duration of engagement or effort in HEPA may represent plausible avenues to promote well-being. Similarly, the promotion of well-being may promote duration and effortful engagement in HEPA. These findings add value for health promotion and well-being promotion specialists to further understand episodic assessments of HEPA contexts. Future research may want to explore duration and effort of HEPA and well-being as potential avenues for the promotion of one another.

Statistically Independent Effects

Further analyses of multiple regressions indicated complimentary and additional findings to mediation results. With the addition of psychological needs satisfaction, the predictor variables significantly predicted episodic positive affect, satisfaction and personal expressiveness but not negative affect (see Model A, Table 21). With the inclusion of episodic HEPA and psychological need satisfaction variables to the covariates in Model B (see Table 22), a statistically significant change in variance was accounted for. However, further analyses of the beta coefficients indicated that when episodic HEPA and psychological need satisfaction variables were added to the models

with covariates, the only well-being index that was uniquely predicted by satisfaction of psychological needs was positive affect. Assessment of the covariate beta coefficients indicated that episodic well-being variables other than the criterion variable were generally the unique predictors of episodic well-being. Interestingly, negative affect was consistently predicted by gender (male), presence of a health condition and global negative affect. Episodic negative affect was not associated with positive affect or personal expressiveness but was negatively associated with satisfaction, findings which give further credence to Deci and Ryan (2002) who contend that the presence and absence of well-being is distinct. Since corresponding global markers were generally not predictive of the HEPA- well-being relationship, findings suggest that episodically measured variables are distinct of global indicators.

Consistent with Lyubomirsky et al. (2005), of the variables assessed, when statistical control was at its most rigorous, effort was the single most predictive indicator of well-being. Furthermore, positive affect was the only episodic well-being variable that was uniquely predicted by perceived psychological needs satisfaction once covariates were included in the model, giving each predictor statistical independence (see Model B, Table 22). These findings offer additional insight to interpretation of mediation results because once predictor variables were given statistical independence, satisfaction of the psychological needs was not uniquely predictive of well-being at the episodic level other than positive affect. These findings suggest that shared variance among the HEPA variables may account for the reason why psychological needs satisfaction mediated the episodic HEPA-satisfaction and HEPA-personal expressiveness relationship.

Further, the unique predictive effects of HEPA-Effort on negative affect, satisfaction, and personal expressiveness were unchanged after statistically controlling for all three of the episodic psychological need satisfaction variables simultaneously – suggesting that these episodic psychological need satisfaction variables did not mediate the effects of HEPA on well-being. This finding suggests that other than positive affect, the satisfaction of each psychological need is statistically not a mechanism of the episodic HEPA-well-being relationship. Perhaps at an episodic level in HEPA contexts, psychological needs satisfaction has a more direct role for well-being. Findings are in contrast to results found from multiple mediation and bivariate correlations as patterns in the data tell different stories depending on the rigour of statistical control on shared variance. When statistical control was not utilized, meaningful associations between HEPA, psychological need satisfaction and well-being were abundant. The difference between these findings was the result of accounting for unique predictive effects. Multiple mediation and bivariate correlations demonstrated that a relationship exists, but the multiple regression findings indicate that those relationships exist because of the shared variance with HEPA-Effort. Both findings are important for understanding the relationship between HEPA, psychological need satisfaction and well-being because to make concise practical recommendations, it's important to understand if variation in two variables tends to overlap. By establishing that a relationship exists, and what accounts for the variance, we can provide insight for health promotion specialists.

Significance of Findings

The bulk of the literature examining associations between physical activity and well-being has been limited to either global or contextual measures of well-being

(Kahneman et al., 2004). By examining an episodic report linking HEPA and well-being, insight into the small, positive meaningful relationship commonly found between physical activity and well-being is garnered (Biddle & Ekkekakis, 2005; Warburton et al., 2007). Time is a finite resource and how people spend it is important to their well-being (Kahneman et al., 2004). Quantitative information about frequency, time use and effortful engagement in HEPA and the utility experienced is potentially useful to health promotion specialists. Beyond insight into an episodic level of measurement, mediation research can help us to understand the mechanisms for achieving the psychological benefits of exercise (Thogersen-Ntoumanis & Ntoumanis 2005) as we learn more about contributing factors and why relationships may exist. Mediation research can help us understand the relationship by unraveling how and why the relationship between HEPA and various aspects of well-being may exist by accounting for shared variance.

This study helps address calls to examine different HEPA types and settings in order to understand the mechanisms for achieving the psychological benefits of exercise (Thogersen-Ntoumanis & Ntoumanis 2005). Few attempts have been made to distinguish the importance of satisfying each basic psychological need through exercise to hedonic versus eudaimonic well-being (Wilson et al., 2006), this study offers some insight. Theoretical implications are raised about the unique predictive effect of psychological needs satisfaction in HEPA contexts and warrants further research to explore this relationship.

Furthermore, theoretical findings add additional value to the study. Findings in support of BPNT (Deci & Ryan, 2002) are mentioned throughout this document; however specific attention should be given to findings which did not support theoretical

tenents. First, according to BPNT, psychological needs satisfaction should directly relate to well-being (i.e., eudaimonic well-being; Deci & Ryan, 2002) which was seen in Table 21 as various psychological need satisfaction variables were predictive of positive affect, satisfaction and personal expressiveness but not predictive of negative affect. However, once satisfaction of the psychological needs was independent of shared variance with HEPA, findings only supported the theory in predicting positive affect (see Tables 21 and 22). Instead, HEPA-effort uniquely predicted variance in satisfaction and personal expressiveness (Model A; see Table 22). Findings suggest that this level of statistical independence reveals the indirect effect of psychological needs satisfaction to be accounted for through shared variance with HEPA-Effort. Future research should explore this finding as this implication suggests that in HEPA contexts, at an episodic level of measurement, psychological needs satisfaction does not uniquely predict well-being other than positive affect. Future research should examine this finding as implications could have wide-spread effects for HEPA-well-being interventions.

Secondly, current findings at an episodic level did not support the idea that psychological needs satisfaction should be more related to eudaimonic (Deci & Ryan, 2002) than hedonic well-being, as bivariate correlations found that psychological need satisfaction had the highest magnitudes of correlation with positive affect and negligible differences between episode satisfaction and personal expressiveness. This finding suggests theoretical tenents may vary depending on level of measurement and operationalization of constructs. Further research should explore this episodic relationship with other conceptualizations of both hedonic and eudaimonic well-being, as well as with different samples to assess validity support of current findings.

Finally, Ryan (1995) argued that testing BPNT in domain specific areas is an important aspect of research. From a statistical standpoint, context-specific research (i.e., HEPA) reduces error variance and maximizes reliability (Ryan, 1995). From a practical perspective, unique characteristics embedded within an environment may differentially influence one psychological need over the others (Ryan, 1995). For example, results did not support the notion that satisfaction of all three psychological needs are necessary for well-being, as only certain psychological needs satisfaction variables showed statistically meaningful indirect effects of the episodic HEPA-well-being relationship. However, Deci and Ryan (2002) contend that while all three psychological needs are important to well-being, the manner in which they are satisfied may vary by context and situation (Ryan, 1995). The present investigation adopted episodic measures of well-being to determine an association with psychological need satisfaction in HEPA contexts experienced yesterday. This is the first study to our knowledge that assesses the episodic relationship between HEPA- and well-being and the manner in which psychological need satisfaction mediates this relationship.

Multiple regression results offer additional insight to interpretation of mediation results because once predictor variables were examined simultaneously (and thus statistically controlled for the effects of the other variables in the models), satisfaction of the psychological needs was not uniquely predictive of well-being other than positive affect. These findings suggest that the reason why psychological needs satisfaction mediated the episodic HEPA-satisfaction and HEPA-personal expressiveness relationships was because of shared variance between HEPA-Effort and satisfaction of the three psychological needs. This finding adds significance to the current study

because it suggests at an episodic level that HEPA-Effort is the sole predictor of episode satisfaction and personal expressiveness (Model A; Table 22). By consequence, the psychological need satisfaction variables collectively did not mediate the relations between HEPA-effort and the well-being indicators. This has implications for future research that may want to focus on the promotion of effort in HEPA contexts as it is a unique predictor of aspects of well-being– and its link may not necessarily be explained by, or carried through, greater satisfaction of basic psychological needs.

Limitations and Future Directions

While this study holds theoretical and empirical merit, a number of limitations and future directions require acknowledgement to advance our understanding of the role of HEPA on well-being. Each limitation is presented below accompanied by suggestions for future research.

Data collection procedures included non-probability based sampling which limits the external validity given the inability to determine whether the cohort sampled represents the target population (Vincent, 2005). Consequently, conclusions warrant replication and extension adopting greater diversity in demographic cohorts and probability-based sampling procedures. Through consideration of the above, questions can be addressed for cohorts (e.g., inactive individuals, older adults, etc.) for whom issues of behaviour persistence and well-being remain important challenges.

Conclusions from the present investigation emanated from an exclusive reliance on self-report data, at the exclusion of complementary methods (e.g., motion accelerometry, pedometers). Given the study variables assessed, it was necessary to use self-report instruments to evaluate psychological well-being and perceived psychological

need satisfaction (Deci & Ryan, 2002). Despite interpretational problems (e.g., recall bias and social desirability), Welk, (2002), noted that self-report measures of physical activity behaviour can be an acceptable method of measurement. Future studies may want to adopt less subjective methods of measuring HEPA to provide complementary information and avoid concerns raised over mono-method bias (Pedhauzer & Schmelkin, 1991).

Further, the non-experimental cross-sectional design limits causal claims (Preacher & Hayes, 2008; Vincent, 2005) surrounding the role of psychological need satisfaction in the HEPA-well-being relationship. Cross-sectional designs offer minimal insight into causal flow between constructs because they fail to satisfy issues of temporal precedence and satisfactorily account for extraneous influences (Vincent, 2005). This limitation is not unique to the present study and has been reported in a plethora of BPNT-based research investigation within exercise psychology (Gunnell et al., in press, Wilson et al., 2009, Mack et al., 2011). Future investigations may want to adopt a longitudinal approach to offer greater insight into causal relations amongst variables integral to the BPNT (Deci & Ryan, 2002) and would provide more credibility to the interpretation of the mediation analysis (Preacher & Hayes, 2007). Thoughtful attention to the temporal period selected for examination is necessary such that meaningful change can be captured and relevant change is not obfuscated (Backhouse, Ekkekakis, Biddle, Foskett, & Williams, 2007). Ultimately, if future research establishes temporal precedence and can rule out any other influencing variable (i.e., a causal relationship) between HEPA and well-being, health promotion practitioners could promote HEPA for the psychological

benefits in addition to the well-known physiological benefits (e.g., lower blood pressure, decreased risk of heart disease; WHO, 2009).

Beyond the three basic psychological needs embedded within BPNT (Deci & Ryan, 2002), Sheldon, Elliot, Kim, and Kasser, (2001) suggests that additional basic psychological needs may exist. As Deci and Ryan (2002) claim that the fulfillment of each basic psychological need is integral to an individual's psychological well-being, the exclusion of 'additional' basic psychological needs (e.g., self-esteem) may limit study conclusions. By considering additional potential psychological needs, further elucidation of potential mechanisms responsible for the mediating relationship between HEPA and well-being may have been derived. Future research should try to account for the additional variance not explained by current findings in order to further understand the factors involved before implementing a research design that could account for a causal link.

Previous research attests to the difficulties pertaining to the measurement of psychological need satisfaction both in general (Sheldon, 2002) and in exercise contexts (Wilson et al., 2003). The measure of psychological need satisfaction used in this investigation was originally designed to measure psychological need fulfillment in general and as a result the instrument was modified in the present investigation to relate to episodes of HEPA. Measurement experts (Crocker & Algina, 1986) have discouraged the use of modified instruments over concerns to item content relevance and representation that may translate into confounded appraisals of construct validity. Single item indicators were used to measure episodic psychological need satisfaction (Sheldon & Elliot, 1999) and episode satisfaction (Diener et al., 2009; White & Dolan, 2009) to

reduce respondent burden. However, ongoing assessments of reliability and validity (Messick, 1995) in the present study are limited as a result. As such, present findings should be interpreted with caution (Crocker & Algina, 1986).

Effort was assessed via single item indicator developed by Parisi (2010) as opposed to other known indicators used to assess effort of physical activity (e.g., Borg Perceived Exertion Scale, 1982). The purposeful selection of this indicator was consistent with Sheldon and Lyubomirsky (2006) suggestion that intentional activities involve effort that may come in the form of cognitive and/or physical intensity. Given the unique findings of effort in the present investigation, a cautionary note may be advanced until greater support for the construct validity of scores from this item are advanced.

As the current study focused on individual psychological need satisfaction and unique predictors, another possible avenue for future investigation and theoretical refinement may be to examine the role of balanced psychological need fulfillment on well-being (Sheldon & Niemiec, 2006) as one complementary approach to the direct influence posited by Deci and Ryan (2002).

The present study utilized an omnibus estimate of HEPA and did not differentiate between varied components of HEPA (e.g., active transportation) on well-being. Existing research has suggested that different HEPA components vary in their relationship with well-being (Cerin et al., 2009; Kim et al., 2008). For example, studies have found household chores and commuting to be associated moreso with less positive affect and more negative affect than leisure pursuits (Robinson & Godbey, 1999; White & Dolan, 2009). As such, the magnitude of the HEPA – well-being relationship

documented may be obfuscated. Future research should breakdown the various dimensions of HEPA to further elucidate the potentially important elements in obtaining psychological benefits from HEPA.

Despite the importance of theory driven research to understanding health (Glanz, Lewis, & Rimer, 1997), the present investigation was guided by one theory (BPNT; Deci & Ryan, 2002) which limits the scope of variables considered. Other potential variables (e.g., self-efficacy, social support) that have demonstrated their role in the physical activity – well-being relationship (Bandura, 1997) were ignored. Along similar lines, this investigation had the restricted array of criterion variables. Psychological well-being has been construed as a multifaceted construct (Ryan et al., 2008; Ryff & Singer, 2008; Waterman, 1993; 2007) and although multiple markers of psychological well-being were assessed, varied conceptualizations of eudaimonic well-being (e.g., Csikszentmihalyi, 1975; Ryff, 1989; Ryan & Deci, 2001; Waterman, 1984, 1993) have been advanced. Attention to additional well-being markers (e.g., self-acceptance; Ryff et al., 2006) may prove useful for future research as they represent content domains relevant to study objectives.

Although the present study controlled for global indicators of HEPA, psychological needs satisfaction and episodic well-being, this study did not measure other non-HEPA activities (i.e., what else people were doing during their day) adding another limitation to the study. These activities (and associated psychological need satisfaction and derived well-being) may be relevant to understanding the 'benefits' of HEPA involvement. Other types of daily activities (i.e., studying, class work etc.) were not assessed, leaving more opportunity for future research.

Another limitation to interpretation of study findings is due to the use of statistical control. Kahneman (1965) noted the problems involved in undercontrol that usually occur because most variables are measured imperfectly. As a result of many factors including measurement error, restricted range of constructs, unexplained variance etc., undercontrol is likely. Meehl (1970) on the other hand noted a problem involved in overcontrol (i.e., systematic unmatching), where by controlling for one factor, the sample becomes statistically unmatched on other factors. For example, when we control for positive affect (i.e., other episodic well-being variables) in the prediction of satisfaction (i.e., episodic well-being), because positive affect predicts satisfaction, and we hold it constant, we make participants less similar on other input variables (potentially psychological need satisfaction). Another problem when interpreting findings from statistical control is that greater weighting is given to less common participants. Statistical control makes the resulting sample less representative of the population they are meant to represent.

Conclusion

The primary objective of this study was to test the episodic relationship between HEPA and well-being in a sample of undergraduate students. A secondary objective was to explore the role of psychological need fulfillment (Deci & Ryan, 2002) in the HEPA – well-being relationship. Results derived from this investigation suggest that there is a positive association between HEPA and well-being at an episodic level of measurement in university students. The fulfillment of the psychological needs for competence, autonomy and relatedness may serve as intervening variables in this relationship. As such, intervention programs that seek to improve the psychological well-being of

university students may wish to use a HEPA program that specifically facilitates the fulfillment of the psychological needs for effectiveness (i.e., competence), choice (i.e., autonomy) and belonging (i.e., relatedness). HEPA represents an important avenue to help improve well-being.

The textured nature of HEPA (i.e., frequency, duration and intensity) and well-being (i.e., hedonic and eudaimonic forms) contributed to the uniqueness of study findings. Specifically, HEPA-Effort demonstrated to be a dominant predictor of positive affect, satisfaction, personal expressiveness, as well as feelings of competence, autonomy and relatedness. When examined individually, psychological needs satisfaction variables were statistically independent mediators of the HEPA-Effort and positive affect relationship. When examined jointly, however, the psychological need satisfaction variables were not found to mediate the links between HEPA-effort and well-being indicators. Statistically, findings provide additional conclusions concerning the unique roles of the episodic HEPA facets and the unique roles of basic psychological need satisfaction. These findings don't allow for practical recommendations as these unique roles are only possible through statistical techniques. However, specific insight into the HEPA- well-being relationship is further advanced.

Overall, the results of the investigation highlight the importance of effort in predicting well-being in HEPA contexts. With research (i.e., Lyubomirsky et al., 2005) advocating that 40% of our well-being is accounted for by the intentional (effortful) activities we engage in, HEPA holds potential in the promotion of well-being. Psychological need fulfillment within the context of HEPA, demonstrated to be one partial mechanism underpinning this relationship. It might it be useful in future research

to address a variety of levels of measurement (i.e., global, episodic etc.,) as insight can be gained from each (Diener & Chan 2011, Kahneman et al., 2004). Differences in conclusions emanating from episodic-level variables with and without controlling for covariates represents one challenge to be considered in future investigations. Notwithstanding these challenges, this study provides general support for the HEPA – well-being relationship and should not be ignored despite the magnitude of association reported (Prentice & Miller, 1992). Collectively, results of this study offer promising insight into the role of psychological need satisfaction on the relationship between HEPA and well-being with challenges and suggestions for future research advanced.

Footnotes

1. Episodic GLTEQ scores were not used as the measure of HEPA for the previous day because of missing data from 67 participants.
2. Baron and Kenny's (1986) guidelines for establishing mediation through a set of multiple linear regression analyses was employed to gain further insight to the relationship between HEPA, well-being and BPNS. According to Baron and Kenny's (1986) first condition the independent variable (e.g., HEPA effort) must significantly affect the dependent variable (e.g., positive affect). For example, health-enhancing physical activity (HEPA) must significantly affect well-being. In the second condition, the independent variable must significantly predict the mediating variable (e.g., HEPA predicts psychological need satisfaction). The third condition of Baron and Kenny's (1986) approach requires that the mediator significantly affects the dependent variable when regressed with the predictor. An example for this case would be that competence, when regressed with HEPA-Effort, can significantly predict positive affect. Finally, Baron and Kenny's (1986) fourth condition states that the effect of the predictor on the dependent variable must be less when regressed with the mediator than when regressed without it. For instance, as the example above would suggest, the effect of HEPA-Effort on positive affect would be less when regressed with competence than when it is regressed alone. Complete mediation occurs if the predictor has no effect when the mediator is controlled for in the fourth condition. Partial mediation occurs when the fourth condition is upheld but the predictor still has a significant effect on the dependent variable.

Sobel test

As recommended by Preacher and Hayes (2004) testing the significance of indirect effects were also examined through the traditional causal steps approach as insight can be gained by using both methods. Sobel test (Sobel 1982) was conducted to test indirect effects through the causal steps approach (i.e., the significance of the mediated effect; http://people.ku.edu/~preacher/sobel/sobel.htm). For example, Sobel's (1982) test assesses whether the mediating variable (i.e., competence) carries the effects of the independent variable (i.e., HEPA- Frequency) to a dependent variable (i.e., personal expressiveness). The resulting statistic measures the indirect effect of the HEPA-Frequency on personal expressiveness by way of competence.

Positive Affect. Following Baron and Kenny's (1986) causal steps approach to assess mediation, HEPA-Frequency and positive affect showed basic psychological needs satisfaction not to be statistical significant mediators (see Table 23). Analyses preceded assessing possible mediation of the HEPA-Duration-positive affect relationship. Fulfillment of each of the three psychological needs were regressed on HEPA-Duration and positive affect. Significant relationships were found between HEPA-Duration and the basic psychological need satisfaction for competence ($t = 2.92$; $p = .00$) and relatedness ($t = 2.56$; $p = .01$), but not autonomy ($t = 1.46$; $p = .15$; see Table 23). A statistically significant relationship between HEPA-Duration and positive affect ($\beta = .20$, $p = .01$; see Table 23), was significant as well. Assessment of Baron and Kenny's (1986) third condition showed significant relationships between

fulfillment of each of the psychological needs for competence (t = 4.12; p = .00), autonomy (t = 4.63; p = .00), and relatedness (t = 5.39; p = .00; see Table 23) and positive affect. The fourth condition to confer mediation showed complete mediation after statistically controlling for competence (β = .08, p = .18; z = 2.80, p = .01), partial mediation after statistically controlling for autonomy (β = .11, p = .01; z = 0.65, p = .51), and complete mediation when relatedness was statistically controlled for (β = .11, p = .08; z = 2.38, p = .02). The Sobel test (Sobel, 1982) supported competence and relatedness as unique mediators (see Table 23).

Further analyses testing possible mediation of the HEPA-Effort-positive affect relationship followed. Satisfaction of each of the three psychological needs were regressed on HEPA-Effort and positive affect. Statistically significant relationships were found between HEPA-Effort and the basic psychological needs for competence (t = 5.28; p = .00), autonomy (t = 5.15; p = .00) and relatedness (t = 4.75; p = .00; see Table 23). A statistically significant relationship was also found between HEPA-Effort and positive affect (β = .51, p = .00; see Table 23) as well. The third condition showed statistically significant relationships between satisfaction of each of the psychological needs for competence (t = 2.32; p = .02), autonomy (t = 2.24; p = .03), and relatedness (t = 3.57; p = .00; see Table 23) and positive affect. The fourth condition to confer mediation showed partial mediation after statistically controlling for competence (β = .33, p = .00; z = 4.58, p = .00), autonomy (β = .34, p = .00; z = 0.98, p = .33) and relatedness (β = .37, p = .02; z = 2.75, p = .01; see Table 23). The Sobel test (Sobel, 1982) supported competence and relatedness as unique mediators (see Table 23).

Negative Affect. No statistically significant relationships were found between HEPA-Frequency and fulfillment of the basic psychological needs for competence (t = .10; p = .92), autonomy (t = .67; p = .50), or relatedness (t = -1.25; p = .21; see Table 24). Analyzing frequency of HEPA episodes and negative affect showed no significant relationship (β = -.10, p = .15; see Table 24). As results showed no significant prediction of either of the first two conditions for mediation, further steps did not continue between HEPA-Frequency and negative affect.

Further testing assessed possible mediation of the HEPA-Duration-negative affect relationship. Again, Baron and Kenny's causal steps were tested as satisfaction of each of the three psychological needs were regressed on HEPA-Duration and negative affect. Fulfillment of two psychological needs demonstrated statistically significant relationships with HEPA-Duration (i.e., competence (t = 2.91; p = .00) and relatedness (t = 2.44; p = .02; see Table 24)). However, condition two was not satisfied as HEPA-Duration and negative affect (β = -.03, p = .68) failed to show a significant relationship. As results showed no significant prediction of the second condition for mediation, further steps did not continue between HEPA-Duration and negative affect.

Lastly, possible mediation of the HEPA-Effort-negative affect relationship was tested. Fulfillment of each of the three psychological needs were regressed on HEPA-Effort and negative affect. All three needs showed statistically significant relationships with HEPA-Effort and competence (t = 5.36; p = .00) autonomy (t = 5.18; p = .00) and relatedness (t = 4.89; p = .00; see Table 24).

Condition two was again not satisfied as HEPA-Effort and negative affect (β = -.02, p = .79) was not significant. Since the second condition for mediation was not satisfied, further steps did not continue.

Satisfaction. HEPA-Frequency and satisfaction were then tested through the causal steps approach to determine whether a mediating effect of fulfillment of the basic psychological needs was present. In accordance with Baron and Kenny's (1986), as the first two conditions for mediation were not present, further steps did not continue between HEPA-Frequency and satisfaction.

Mediation was then assessed between HEPA-Duration and satisfaction. Fulfillment of the three psychological needs were regressed on HEPA-Duration and satisfaction. Statistically significant relationships were found between HEPA-Duration and psychological need satisfaction for competence (t = 2.89; p = .00) and relatedness (t = 2.50; p = .01) but not autonomy (t = 1.35; p = .18; see Table 20). Between HEPA-Duration and satisfaction (β = .18, p = .01) a significant relationship was found as well. Assessment of Baron and Kenny's (1986) third condition showed significant relationships between the psychological need satisfaction for competence (t = 3.75; p = .00), autonomy (t = 5.00; p = .00) and relatedness (t = 3.58; p = .00; see Table 25) and satisfaction. The fourth condition to confer mediation showed complete mediation after statistically controlling for competence (β = .13, p = .06; z = 2.24, p = .03), partial mediation after controlling for autonomy (β = .15, p = .02; z = 1.28, p = .21), and relatedness (β = .14, p = .05; z = 2.00, p = .05). The Sobel test (Sobel, 1982) supported

perceived satisfaction of competence and relatedness as unique mediators (see Table 25).

Further analyses testing possible mediation of the HEPA-Effort-satisfaction relationship followed. Satisfaction of each of the three psychological needs were regressed on HEPA-Effort and satisfaction. Statistically significant relationships were found between HEPA-Effort and fulfillment of the basic psychological needs for competence (t = 5.16; p = .00), autonomy (t = 4.88; p = .00) and relatedness (t = 4.78; p = .00; see Table 25). A statistically significant relationship was also found between HEPA-Effort and satisfaction (β = .46, p = .00; see Table 20) as well. The third condition showed significant relationships between satisfaction of each of the psychological needs for competence (t = 2.66; p = .01) autonomy (t = 3.09; p = .00) and relatedness (t = 1.99; p = .05; see Table 25) and satisfaction. The fourth condition to confer mediation showed partial mediation after statistically controlling for competence (β = .40, p = .00; z = 2.33 p = .02), autonomy (β = .39, p = .00; z = 2.57, p = .01) and relatedness (β = .42, p = .00; z = 1.80, p = .07; see Table 25). The Sobel test (Sobel, 1982) supported perceived competence and autonomy as unique mediators (see Table 25).

Personal Expressiveness. HEPA-Frequency and personal expressiveness were also tested through the causal steps approach to determine whether a mediating effect of fulfillment of the basic psychological needs was present by regressing each need with HEPA-Frequency and personal expressiveness. As the first two conditions for mediation were not present, further steps did not continue between HEPA-Frequency and satisfaction.

Mediation using Baron and Kenny's causal steps approach was then assessed between HEPA-Duration and personal expressiveness. The three psychological needs satisfaction variables were regressed on HEPA-Duration and satisfaction. Statistically significant relationships were found between HEPA-Duration and satisfaction of the psychological needs for competence (t = 2.92; p = .00) and relatedness (t = 2.48*;* p = .00) but not autonomy (t = .70; p = .49; see Table 26). Between HEPA-Duration and personal expressiveness (β = .23, p = .00) a significant relationship was found as well. Assessment of Baron and Kenny's (1986) third condition showed significant relationships between fulfillment of the psychological needs for competence (t = 10.44; p = .00), autonomy (t = 3.17; p = .00) and relatedness (t = 8.77; p = .00; see Table 26) and personal expressiveness. The fourth condition to confer mediation showed partial mediation after statistically controlling for competence (β = .17, p = .01; z = 2.80, p = .01), autonomy (β = .20, p = .00; z = .65, p = .51), and relatedness (β = .17, p = .01; z = 2.38, p = .02). The Sobel test (Sobel, 1982) supported perceived competence and relatedness as unique mediators (see Table 26).

Lastly, analyses testing possible mediation of the HEPA-Effort-personal expressiveness were conducted. Satisfaction of each of the three psychological needs were regressed on HEPA-Effort and personal expressiveness. Statistically significant relationships were found between HEPA-Effort and satisfaction of the psychological needs for competence (t = 5.38; p = .00) and relatedness (t = 4.78*;* p = .00) but not with autonomy (t = 1.11; p = . 27; see Table 26). A statistically significant relationship was also found between HEPA-Effort and personal

expressiveness directly (β = .63, p = .00; see Table 26) as well. The third condition of the causal steps approach (Baron & Kenny, 1986) showed significant relationships between psychological need satisfaction for competence (t = 8.91; p = .00) autonomy (t = 2.77; p = .01) and relatedness (t = 3.44; p = .00; see Table 26) and personal expressiveness. The fourth condition to confer mediation showed partial mediation after statistically controlling for the perceived satisfaction of competence (β = .58, p = .00; z = 4.58 p = .00) autonomy (β = .15, p = .02; z = .98, p = .33) and relatedness (β = .14, p = .05; z = 2.75, p = .01; see Table 26). The Sobel test (Sobel, 1982) supported perceived competence and relatedness as unique mediators.

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Table 1

Descriptive Statistics for Demographic Variables

Variable	%
Gender	
Male	35.50
Female	64.50
Highest level of Education	
Some College/University	85.20
College/University Degree	10.80
Some Graduate School	3.40
Graduate Degree	0.50
Marital Status	
Single	97.00
Married/Common Law	2.50
Divorced/Separated	0.50
Ethnicity	
Aboriginals of Canada	0.50
Hispanic	1.00
Caucasian	94.60
Asian Canadian	1.50
South Asian/Indian Subcontinent	0.50
Multi-racial	1.00
Other	1.00
Diagnosed with a Chronic Health Condition	
Yes	11.80
No	88.20

Note: Sample ranged from 202-203 depending on level (or amount) of missing cases per participant.

Table 2
Modes of HEPA

Mode	Number of Participants reporting episodes	%
Commuting	134	30.46
Leisure	130	29.55
Sport	63	14.32
Structured Exercise	28	6.36
Occupational	42	9.55
Household	43	9.77

Note: N = 203.

Table 3

Descriptive Statistics for Global Indices

Variable	*M*	*SD*	*Skewness*	*Kurtosis*
1. Positive Affect	3.72	0.53	-0.72	2.88
2. Negative Affect	1.94	0.62	0.98	1.67
3. SWLS	5.39	0.94	-1.10	1.84
7. QEW	2.62	0.36	0.13	-0.41
4. BNSG-C	5.14	0.85	-0.51	0.86
5. BNSG-A	5.02	0.82	-0.44	0.13
6. BNSG-R	3.78	0.58	-0.54	-0.34
8. GLTEQ	83.00	35.24	1.21	3.54

Note. Sample sizes range from 200 to 202 depending on level (or amount) of missing cases per participant. *M* = Mean; *SD* = Standard Deviation; SWL = Satisfaction with Life Scale; BNSG = Basic Need Satisfaction in General Scale; C = Competence; A = Autonomy; R = Relatedness; QEW = Questionnaire for Eudaimonic Well-being; GLTEQ = Godin Leisure-Time Exercise Questionnaire.

Table 4

Pearson Bivariate Correlations and Estimates of Internal Consistency Between Global Study Variables

Variable	1	2	3	4	5	6	7	8
PANAS - PA	.72							
PANAS - NA	-.05 [-.19, .09]	.79						
SWL	.42 [.29, .52]	-.13 [-.26, .01]	.85					
QEW	.56 [.46, .65]	-.06 [-.20, .08]	.46 [.34, .56]	.57				
BNSG-C	.61 [.52, .69]	-.22 [-.35, -.08]	.51 [.40, .61]	.63 [.54, .70]	.68			
BNSG-A	.34 [.21, .46]	-.25 [-.38, -.12]	.49 [.38, .59]	.37 [.24, .48]	.57 [.47, .65]	.65		
BNSG-R	.36 [.23, .48]	-.20 [-.33, -.06]	.47 [.36, .57]	.40 [.28, .51]	.66 [.57, .73]	.57 [.47, .66]	.75	
GLTEQ	.16 [.02, .30]	-.06 [-.20, .08]	.14 [.00, .27]	.12 [-.01, .26]	.13 [-.01, .26]	.17 [.03, .30]	.15 [.01, .28]	___

Note. Sample sizes range from 199 to 202 based on participant responses. PANAS = Positive and Negative Affect Schedule; PA = Positive Affect; NA = Negative Affect; SWL = Satisfaction with Life Scale; QEW = Questionnaire for Eudaimonic Well-being; BNSG = Basic Need Satisfaction in General Scale; A = Autonomy; C = Competence; R = Relatedness; GLTEQ = Godin Leisure-Time Physical Activity Questionnaire; Estimates of internal consistency (Cronbach α's , Cronbach, 1951) are located along the diagonal. All *r's* > |.17 | significant at $p < .001$ (two-tailed). All *r's* > |.13| but less than |.17| significant at $p < .05$ (two tailed). Values in parentheses represent 95% Confidence Intervals.

Table 5

Descriptive Statistics for Aggregated Episodic Variables

Variable	*M*	*SD*	Skewness	Kurtosis
1. ACL - PA	4.97	1.18	-0.71	1.20
2. ACL - NA	1.61	0.66	1.15	1.20
3. SAT	1.67	1.01	-0.92	3.37
4. PE	3.45	1.29	-0.12	-0.35
5. BNS-C	5.94	1.14	-1.56	3.36
6. BNS-A	5.56	1.28	-1.22	1.82
7. BNS-R	4.72	1.46	-0.49	0.07
8. HEPA-Frequency	3.43	1.41	0.19	-0.42
9. HEPA-Duration	202.10	122.17	1.00	0.72
10. HEPA- Effort	4.05	1.29	-0.60	0.22

Note. Sample sizes range from 197 to 201 based on participant responses. *M* = Mean; *SD* = Standard Deviation; ACL = Adjective Checklist; PA = Positive Affect; NA = Negative Affect; SAT = Satisfaction with episode; PE = Personal Expressiveness; BNS = Basic Need Satisfaction; C = Competence; A = Autonomy; R = Relatedness; HEPA = Health Enhancing Physical Activity; Frequency = total episodes; Duration = total time; Effort =
mean effort.

Table 6

Pearson Bivariate Correlations Between Episodic Study Variables

Variable	1	2	3	4	5	6	7	8	9
1. ACL - PA	.94								
2. ACL - NA	-.22 [-.35, -09]	.74							
3. Satisfaction	.61 [.52, .69]	-.28 [-.40, - .14]	---						
4. PE	.63 [.54, .71]	-.06 [-.20, .08]	.61 [.51, .69]	.97					
5. BNS-C	.61 [.52, .69]	-.11 [-.26, .02]	.29 [.15, .41]	.32 [.19, .44]	---				
6. BNS-A	.61 [.52, .69]	-.08 [-.22, .05]	.35 [.22, .46]	.33 [.20, .45]	.74 [.67, .80]	---			
7. BNS-R	.55 [.44, .64]	-.07 [-.21, .07]	.27 [.14, .40]	.39 [.26, .50]	.47 [.35, .57]	.43 [.31, .54]	---		
8. HEPA-Frequency	-.05 [-.18, .09]	-.11 [-.25, .03]	.10 [-.05, .23]	-.04 [-.18, .10]	.01 [-.13, .15]	.05 [-.10, .18]	-.10 [-.22, .05]	---	
9. HEPA-Duration	.20 [.06, .33]	-.03 [-.17, .11]	.18 [.05, .31]	.23 [.10, .36]	.20 [.07, .33]	.10 [-.04, .23]	.17 [.03, .30]	.22 [.08, .35]	---
10. HEPA- Effort	.51 [.40, .61]	.02 [-.12,.16]	.46 [.34, .56]	.62 [.53, .70]	.36 [.23, .48]	.35 [.22, .46]	.33 [.20, .45]	-.16 [-.30, -.02]	.20 [.06, .33]

Note. Sample sizes range from 194 to 201 based on participant responses. ACL = Adjective Checklist; PA = Positive Affect; NA = Negative Affect; Satisfaction = Satisfaction with episode; PE = Personal Expressiveness; BNS = Basic Need Satisfaction; C = Competence; A = Autonomy; R = Relatedness; HEPA = Health Enhancing Physical Activity; Frequency = total episodes; Duration = total time; Effort = mean effort. Estimates of internal consistency (Cronbach α's, Cronbach, 1951) are located along the diagonal. All *r's* ≥ |.18 | significant at $p < .001$ (two-tailed). All *r's* ≥ |.14| but less than |.18| significant at $p < .05$ (two tailed). Values in parentheses represent 95% Confidence Intervals.

Table 7

Pearson Bivariate Correlations Between Global and Episodic Study Variables

Variable	1	2	3	4	5	6	7	8
1. PANAS - PA								
2. ACL - PA	.23 [.09, .36]							
3. PANAS – NA	-.05 [-.19, .09]	-.06 [-.20, .08]						
4. ACL - NA	-.11 [-.25, .03]	-.22 [-.35, -.09]	.28 [.15, .40]					
5. SWL	.42 [.30, .53]	.10 [-.04, .24]	-.13 [-.26, .01]	-.15 [-.28, -.01]				
6. SAT	.33 [.20, .45]	.61 [.52, .69]	-.06 [-.20, .08]	-.28 [-.40, -.15]	.13 [-.01, .26]			
7. QEW	.56 [.46, .65]	.22 [.09, .35]	-.06 [-.20, .08]	-.11 [-.24, .03]	.46 [.34, .56]	.25 [.12, .38]		
8. PE	.23 [.09, .36]	.64 [.55, .72]	-.08 [-.22, .06]	-.06 [-.20, .08]	.11 [-.03, .25]	.61 [.52, .69]	.23 [.10, .36]	
9. BNSG-C	.61 [.52, .69]	.25 [.12, .38]	-.22 [-.35, -.08]	-.26 [-.38, -.13]	.51 [.40, .61]	.28 [.15, .40]	.63 [.54, .71]	.18 [.04, .31]
10. Episodic BNS-C	-.03 [-.17, .11]	.61 [.52, .69]	-.07 [-.21, .07]	-.11 [-.24, .03]	.00 [-.14, .14]	.29 [.16, .41]	.03 [-.11, .17]	.32 [.19, .44]
11. BNSG-A	.34 [.21, .46]	.15 [.01, .28]	-.25 [-.38, -.12]	-.30 [-.42, -.17]	.49 [.38, .59]	.13 [-.00, .26]	.37 [.25, .48]	.04 [-.10, .18]
12. Episodic BNS-A	.06 [-.08, .20]	.60 [.50, .68]	-.00 [-.14, .14]	-.08 [-.22, .06]	.04 [-.10, .18]	.35 [.22, .47]	.03 [-.11, .17]	.33 [.20, .45]
13. BNSG-R	.36 [.23, .48]	.12 [.02, .25]	-.20 [-.33, -.06]	-.28 [-.40, -.15]	.47 [.36, .57]	.16 [.02, .29]	.40 [.28, .51]	.04 [-.10, .18]
14. Episodic BNS-R	.13 [-.01, .26]	.55 [.45, .64]	-.03 [-.17, .11]	-.07 [-.21, .07]	.09 [-.05, .23]	.27 [.14, .39]	.15 [.01, .28]	.39 [.27, .50]
15. GLTEQ	.16 [.02, .29]	.15 [.01, .28]	-.06 [-.20, .08]	-.10 [-.23, .04]	.14 [.00, .27]	.17 [.03, .30]	.12 [-.02, .25]	.20 [.06, .33]
16. HEPA-Frequency	.11 [-.03, .25]	-.05 [-.19, .09]	-.02 [-.16, .12]	-.10 [-.24, .04]	.16 [.02, .29]	.09 [-.05, .23]	-.04 [-.18, .10]	-.06 [-.20, .08]
17. HEPA-Duration	.03 [-.11, .17]	.20 [.06, .33]	.01 [-.13, .15]	-.03 [-.17, .11]	-.04 [-.18, .10]	.18 [.04, .31]	.04 [-.10, .18]	.23 [.10, .36]
18. HEPA-Effort	.17 [.03, .30]	.51 [.40, .61]	-.06 [-.20, .08]	.02 [-.12, .16]	.10 [-.04, .24]	.46 [.34, .56]	.14 [.00, .27]	.63 [.54, .71]

Note. Sample sizes range from 195 to 202 based on participant responses. PANAS = Positive and Negative Affect Schedule; ACL = Adjective Checklist; PA = Positive Affect; NA = Negative Affect; SWL = Satisfaction with Life Scale; SAT = Satisfaction with Episode; QEW = Questionnaire for Eudaimonic Well-being; PE = Personal Expressiveness; BNSG = Basic Need Satisfaction in General Scale; A = Autonomy; C = Competence; R = Relatedness; GLTEQ = Godin Leisure-Time Physical Activity Questionnaire; HEPA = Health Enhancing Physical Activity; All *r's* > |.17 | significant at $p < .001$ (two-tailed). All *r's* ≥ |.14| but less than or equal to |.17| significant at $p < .05$ (two tailed). Values in parentheses represent 95% Confidence Intervals.

Table 7 Continued

Pearson Bivariate Correlations Between Global and Episodic Study Variables

	9	10	11	12	13	14	15	16	17
9. BNSG-C									
10. Episodic BNS-C	.11 [-.03, .24]								
11. BNSG-A	.57 [.47, .66]	-.01 [-.15, .13]							
12. Episodic BNS-A	.10 [-.04, .24]	.74 [.67, .80]	-.00 [-.14, .14]						
13. BNSG-R	.66 [.58, .73]	.02 [-.12, .16]	.57 [.47, .66]	.04 [-.10, .18]					
14. Episodic BNS-R	.19 [.05, .32]	.47 [.36, .57]	.08 [-.06, .22]	.43 [.31, .54]	.12 [-.02, .25]				
15. GLTEQ	.13 [-.01, .26]	.07 [-.07, .21]	.17 [.03, .30]	.09 [-.05, .23]	.15 [.01, .28]	.13 [-.01, .26]			
16. HEPA- Frequency	.10 [-.04, .24]	.01 [-.13, .15]	.14 [.00, .27]	.05 [-.09, .19]	.05 [-.09, .19]	-.09 [-.23, .05]	.23 [.10, .36]		
17. HEPA- Duration	.04 [-.10, .18]	.20 [.06, .33]	.06 [-.08, .20]	.10 [-.04, .23]	-.05 [-.19, .09]	.17 [.03, .30]	.21 [.08, .34]	.22 [.09, .35]	
18. HEPA- Effort	.20 [.06, .33]	.36 [.23, .48]	.06 [-.08, .20]	.35 [.22, .47]	.07 [-.07, .21]	.33 [.20, .45]	.06 [-.08, .20]	-.16 [-.29, -.02]	.20 [.06, .33]

Note. Sample sizes range from 195 to 202 based on participant responses. BNSG = Basic Need Satisfaction in General Scale; A = Autonomy; C = Competence; R = Relatedness; GLTEQ = Godin Leisure-Time Physical Activity Questionnaire; HEPA = Health Enhancing Physical Activity; All *r's* > |.17 | significant at $p < .001$ (two-tailed). All *r's* ≥ |.14| but less than or equal to |.17| significant at $p < .05$ (two tailed). Values in parentheses represent 95% Confidence Intervals.

Table 8

Partial Correlations Between HEPA and Well-being After Statistically Controlling for Global Indices of LTPA and Well-being

Variable	1	2	3	4	5	6	7
1. ACL-PA	___						
2. ACL-NA	-.22 [-.35, -.08]	___					
3. Satisfaction	.55 [.44, .64]	-.25 [-.38, -.11]	___				
4. PE	.61 [.51, .69]	-.06 [-.20, .09]	.52 [.41, .62]	___			
5. HEPA-Frequency	-.08 [-.22, .07]	-.06 [-.20, .09]	.01 [-.15, .14]	-.13 [-.27, .02]	___		
6. HEPA- Duration	.13 [-.02, .27]	-.02 [-.16, .13]	.10 [-.05, .24]	.17 [.03, .31]	.21 [.07, .34]	___	
7. HEPA- Effort	.44 [.32, .55]	.01 [-.15, .14]	.43 [.30, .54]	.59 [.49,.70]	-.19 [-.32, -.05]	.19 [.05, .32]	___

Note. $N = 183$. ACL = Adjective Checklist; PA = Positive Affect; NA = Negative Affect; Satisfaction = Satisfaction with episode; PE = Personal Expressiveness; HEPA = Health Enhancing Physical Activity; Frequency = total episodes; Duration = total time; Effort = mean effort. ; All $r's \geq |.18|$ significant at $p < .001$ (two-tailed). All $r's \geq |.14|$ but less than $|.18|$ significant at $p < .05$ (two tailed). Values in parentheses represent 95% Confidence Intervals.

Table 9

Partial Correlations Between Measures of HEPA and Psychological Needs Satisfaction After Statistically Controlling for Global LTPA and Psychological Needs Satisfaction

Variable	HEPA-Frequency	HEPA-Duration	HEPA- Effort
1. BNS-C	.01 [-.13, .15]	.18 [.04, .31]	.27 [.13, .40]
2. BNS-A	.03 [-.11, .17]	.04 [-.10, .18]	.27 [.13, .40]
3. BNS-R	-.13 [-.27, .01]	.14 [.00, .28]	.26 [.12, .39]

Note. N = 190. BNS = Basic Need Satisfaction; C = Competence; A = Autonomy; R = Relatedness; HEPA = Health Enhancing Physical Activity; Frequency = total episodes; Duration = total time; Effort = mean effort. All *r's* ≥ |.19 | significant at $p < .001$ (two-tailed). All *r's* ≥ |.16| but less than |.19| significant at $p < .05$ (two tailed). Values in parentheses represent 95% Confidence Intervals.

Table 10

Partial Correlations Between Measures of Well-Being and Psychological Needs Satisfaction After Statistically Controlling for Global levels of Well-Being and Psychological Needs Satisfaction

Variable	Positive Affect	Negative Affect	Satisfaction	Personal Expressiveness
1. BNS-C	.64 [.55, .72]	-.12 [-.26, .02]	.33 [.20, .45]	.34 [.20, .46]
2. BNS-A	.63 [.54, .71]	-.09 [-.23, .05]	.38 [.25, .50]	.34 [.21, .46]
3. BNS-R	.53 [.42, .63]	-.05 [-.20, .09]	.25 [.11, .38]	.39 [.25, .50]

Note. N = 188. BNS = Basic Need Satisfaction; C = Competence; A = Autonomy; R = Relatedness; HEPA = Health Enhancing Physical Activity; Frequency = total episodes; Duration = total time; Effort = mean effort. All r's $\geq |.25|$ significant at $p < .001$ (two-tailed). All r's $\geq |.12|$ but less than $|.25|$ significant at $p < .05$ (two tailed). Values in parentheses represent 95% Confidence Intervals.

Table 11

Bootstrapped Indirect Effects of HEPA on Positive Affect Through Mediators: Without Covariates

Variable	Point Estimate	BCa CI	R^2adj.
Frequency			.44**
Total	-.0086	-.0887 - .0782	
Competence	.0013	-.0263 - .0320	
Autonomy	.0116	-.0238 - .0565	
Relatedness	-.0214	-.0649 - .0094	
C1	-.0103	-.0445 - .0191	
C2	.0227	-.0075 - .0603	
C3	.0330	-.0081 - .0776	
Duration			.49**
Total	.0012	.0004 - .0024	
Competence	.0005	.0001 - .0011	
Autonomy	.0003	-.0001 - .0009	
Relatedness	.0005	.0001 - .0010	
C1	.0002	-.0005 - .0006	
C2	.0000	-.0006 - .0005	
C3	-.0002	-.0007 - .0004	
Effort			.54**
Total	.2206	.1226 - .3634	
Competence	.0752	-.0333 - .1556	
Autonomy	.0721	.0267 - .1439	
Relatedness	.0733	.0276 - .1406	
C1	.0031	-.0695 - .0773	
C2	.0019	-.0642 - .0782	
C3	-.0012	-.0673 - .0705	

Note: C1 = contrast between competence and autonomy, C2 = contrast between competence and relatedness and C3 = contrast between autonomy and relatedness. Number of bootstrap resamples = 5000. BCa CI = Bias Corrected and Accelerated Confidence Intervals. *$p \leq .01$; **$p \leq .001$.

Table 12

Bootstrapped Indirect Effects of HEPA on Negative Affect Through Mediators: Without Covariates

Variable	Point Estimate	BCa CI	R^2adj.
Frequency			.03**
Total	.0020	-.0159 - .0221	
Competence	-.0006	-.0220 - .0111	
Autonomy	.0003	-.0058 - .0124	
Relatedness	.0023	-.0021 - .0155	
C1	-.0009	-.0333 - .0114	
C2	-.0029	-.0194 - .0117	
C3	-.0020	-.0144 - .0092	
Duration			-.01
Total	-.0001	-.0005 - .0001	
Competence	-.0001	-.0005 - .0002	
Autonomy	.0000	-.0001 - .0003	
Relatedness	.0000	-.0002 - .0001	
C1	-.0001	-.0007 - .0003	
C2	-.0001	-.0005 - .0002	
C3	.0000	-.0001 - .0003	
Effort			-.00
Total	-.0244	-.0623 - .0209	
Competence	-.0268	-.0864 - .0198	
Autonomy	.0090	-.0306 - .0576	
Relatedness	-.0067	-.0337 - .0178	
C1	-.0358	-.1323 - .0412	
C2	-.0201	-.0903 - .0377	
C3	.0157	-.0339 - .0704	

Note: C1 = contrast between competence and autonomy, C2 = contrast between competence and relatedness and C3 = contrast between autonomy and relatedness. Number of bootstrap resamples = 5000. BCa CI = Bias Corrected and Accelerated Confidence Intervals. *$p \leq .01$; ** $p \leq .001$.

Table 13

Bootstrapped Indirect Effects of HEPA on Satisfaction Through Mediators: Without Covariates

Variable	Point Estimate	BCa CI	R^2adj.
Frequency			.12**
Total	-.0002	-.0441 - .0499	
Competence	.0002	-.0101 - .0165	
Autonomy	.0105	-.0089 - .0660	
Relatedness	-.0109	-.0456 - .0028	
C1	-.0102	-.0778 - .0105	
C2	.0112	-.0068 - .0453	
C3	.0214	-.0040 - .0664	
Duration			.14**
Total	.0004	-.0001 - .0009	
Competence	.0000	-.0005 - .0003	
Autonomy	.0002	.0000 - .0010	
Relatedness	.0002	.0000 - .0006	
C1	-.0002	-.0015 - .0002	
C2	-.0002	-.0009 - .0002	
C3	.0000	-.0003 - .0007	
Effort			.24**
Total	.0634	.0163 - .1206	
Competence	.0123	-.0297 - .0614	
Autonomy	.0365	-.0037 - .1120	
Relatedness	.0146	-.0206 - .0655	
C1	-.0241	-.1303 - .0459	
C2	-.0023	-.0741 - .0617	
C3	.0218	-.0442 - .1111	

Note: C1 = contrast between competence and autonomy, C2 = contrast between competence and relatedness and C3 = contrast between autonomy and relatedness. Number of bootstrap resamples = 5000. BCa CI = Bias Corrected and Accelerated Confidence Intervals. *$p \leq .01$; **$p \leq .001$.

Table 14

Bootstrapped Indirect Effects of HEPA on Personal Expressiveness Through Mediators: Without Covariates

Variable	Point Estimate	BCa CI	R^2adj.
Frequency			.14**
Total	-.0076	-.0630 - .0543	
Competence	.0008	-.0074 - .0242	
Autonomy	.0060	-.0099 - .0545	
Relatedness	-.0145	-.0577 - .0193	
C1	-.0052	-.0518 - .0142	
C2	.0153	-.0171 - .0579	
C3	-.0205	-.0134 - .0630	
Duration			.19**
Total	.0008	.0002 - .0017	
Competence	.0001	-.0002 - .0006	
Autonomy	.0002	.0000 - .0007	
Relatedness	.0005	.0001 - .0012	
C1	-.0001	-.0008 - .0003	
C2	-.0004	-.0012 - .0001	
C3	-.0003	-.0010 - .0002	
Effort			.42**
Total	.0824	.0269 - .1601	
Competence	.0136	-.0251 - .0665	
Autonomy	.0135	-.0417 - .0757	
Relatedness	.0553	.0144 - .1219	
C1	.0001	-.0866 - .0963	
C2	-.0417	-.1217 - .0194	
C3	-.0417	-.1389 - .0357	

Note: C1 = contrast between competence and autonomy, C2 = contrast between competence and relatedness and C3 = contrast between autonomy and relatedness. Number of bootstrap resamples = 5000. BCa CI = Bias Corrected and Accelerated Confidence Intervals. *$p \leq .01$; ** $p \leq .001$.

Table 15

Bootstrapped Indirect Effects of HEPA on Positive Affect Through Mediators: With Covariates

Variable	Point Estimate	BCa CI	R^2adj.
Frequency			.66**
Total	.0095	-.0419 - .0680	
Competence	.0063	-.0185 - .0359	
Autonomy	.0101	-.0153 - .0424	
Relatedness	.0069	-.0296 - .0049	
C1	-.0039	-.0300 - .0211	
C2	.0132	-.0103 - .0416	
C3	.0170	-.0088 - .0508	
Duration			.69**
Total	.0004	-.0002 - .0012	
Competence	.0003	.0001 - .0008	
Autonomy	.0000	-.0003 - .0003	
Relatedness	.0001	-.0001 - .0004	
C1	.0003	.0000 - .0007	
C2	.0002	-.0001 - .0007	
C3	-.0001	-.0004 - .0002	
Effort			.69**
Total	.0355	-.0422 - .1198	
Competence	.0127	-.0170 - .0583	
Autonomy	.0144	-.0241 - .0636	
Relatedness	.0084	-.0112 - .0382	
C1	-.0017	-.0381 - .0400	
C2	.0044	-.0289 - .0444	
C3	.0060	-.0360 - .0523	

Note: C1 = contrast between competence and autonomy, C2 = contrast between competence and relatedness and C3 = contrast between autonomy and relatedness. Number of bootstrap resamples = 5000. BCa CI = Bias Corrected and Accelerated Confidence Intervals. *$p \leq .01$; **$p \leq .001$.

Table 16

Bootstrapped Indirect Effects of HEPA on Negative Affect Through Mediators: With Covariates

Variable	Point Estimate	BCa CI	R^2adj.
Frequency			.20**
Total	-.0003	-.0172 - .0146	
Competence	-.0039	-.0271 - .0025	
Autonomy	.0038	-.0030 - .0209	
Relatedness	-.0002	-.0072 - .0037	
C1	-.0077	-.0376 - .0037	
C2	-.0037	-.0243 - .0050	
C3	.0039	-.0045 - .0216	
Duration			.19**
Total	.0000	-.0003 - .0002	
Competence	-.0001	-.0003 - .0001	
Autonomy	.0000	-.0001 - .0002	
Relatedness	.0000	.0000 - .0001	
C1	-.0001	-.0004 - .0001	
C2	-.0001	-.0004 - .0001	
C3	.0000	-.0001 - .0002	
Effort			.21**
Total	.0012	-.0143 - .0233	
Competence	-.0019	-.0298 - .0044	
Autonomy	.0032	-.0041 - .0297	
Relatedness	-.0001	-.0090 - .0067	
C1	-.0051	-.0456 - .0068	
C2	-.0019	-.0295 - .0077	
C3	.0032	-.0068 - .0281	

Note: C1 = contrast between competence and autonomy, C2 = contrast between competence and relatedness and C3 = contrast between autonomy and relatedness. Number of bootstrap resamples = 5000. BCa CI = Bias Corrected and Accelerated Confidence Intervals. *$p \leq .01$; **$p \leq .001$.

Table 17

Bootstrapped Indirect Effects of HEPA on Satisfaction Through Mediators: With Covariates

Variable	Point Estimate	BCa CI	R^2adj.
Frequency			.45**
Total	.0059	-.0123 - .0302	
Competence	-.0032	-.0303 - .0045	
Autonomy	.0061	-.0039 - .0366	
Relatedness	.0030	-.0024 - .0233	
C1	-.0093	-.0557 - .0063	
C2	-.0062	-.0323 - .0050	
C3	-.0031	-.0134 - .0299	
Duration			.46**
Total	-.0001	-.0005 - .0001	
Competence	-.0001	-.0005 - .0001	
Autonomy	.0000	-.0001 - .0003	
Relatedness	.0000	-.0003 - .0000	
C1	-.0001	-.0007 - .0001	
C2	-.0001	-.0004 - .0002	
C3	.0001	-.0001 - .0004	
Effort			.47**
Total	-.0006	-.0229 - .0201	
Competence	.0003	-.0114 - .0185	
Autonomy	.0011	-.0071 - .0256	
Relatedness	-.0020	-.0235 - .0064	
C1	-.0008	-.0300 - .0176	
C2	.0023	-.0128 - .0282	
C3	.0031	-.0109 - .0301	

Note: C1 = contrast between competence and autonomy, C2 = contrast between competence and relatedness and C3 = contrast between autonomy and relatedness. Number of bootstrap resamples = 5000. BCa CI = Bias Corrected and Accelerated Confidence Intervals. *$p \leq .01$; **$p \leq .001$.

Table 18

Bootstrapped Indirect Effects of HEPA on Personal Expressiveness Through Mediators: With Covariates

Variable	Point Estimate	BCa CI	R^2adj.
Frequency			.48**
Total	-.0178	-.0518 - .0023	
Competence	-.0021	-.0230 - .0056	
Autonomy	-.0093	-.0368 - .0026	
Relatedness	-.0063	-.0342 - .0047	
C1	.0072	-.0109 - .0396	
C2	.0042	-.0160 - .0288	
C3	-.0030	-.0313 - .0224	
Duration			.50**
Total	.0000	-.0003 - .0004	
Competence	-.0001	-.0004 - .0001	
Autonomy	.0000	-.0002 - .0002	
Relatedness	.0001	.0000 - .0005	
C1	-.0001	-.0003 - .0002	
C2	-.0002	-.0006 - .0000	
C3	-.0001	-.0005 - .0001	
Effort			.61**
Total	.0078	-.0131 - .0421	
Competence	-.0003	-.0140 - .0081	
Autonomy	-.0010	-.0160 - .0247	
Relatedness	.0072	-.0032 - .0374	
C1	-.0013	-.0249 - .0185	
C2	-.0075	-.0402 - .0065	
C3	-.0062	-.0422 - .0160	

Note: C1 = contrast between competence and autonomy, C2 = contrast between competence and relatedness and C3 = contrast between autonomy and relatedness. Number of bootstrap resamples = 5000. BCa CI = Bias Corrected and Accelerated Confidence Intervals. *$p \leq .01$; **$p \leq .001$.

Table 19

Multiple Regressions of Episodic HEPA on Well-Being

	Episodic criteria							
	Positive affect		Negative affect		Satisfaction		Expressiveness	
Predictors	Model A	Model B	Model A	Model B	Model A	Model B	Model A	Model B
	β(B)	β(B)	β(B)	β(B)	β(B)	β(B)	β(B)	β(B)
Covariates								
Gender		0.09 (0.22)		-0.14*(-0.19)		-0.02 (-0.05)		-0.05 (-0.13)
Health condition		0.01 (0.05)		-0.24**(-0.48)		-0.01 (-0.02)		-0.07 (-0.27)
Day of week		0.08 (0.09)		0.02 (0.01)		-0.04 (-0.04)		-0.01 (-0.02)
Global competence		0.07 (0.09)		-0.12 (-0.09)		0.07 (0.07)		-0.05 (-0.07)
Global autonomy		0.07 (0.10)		-0.12 (-0.10)		-0.08 (-0.09)		-0.03 (-0.04)
Global relatedness		0.03 (0.06)		-0.05 (-0.06)		-0.01 (-0.01)		-0.13 (-0.27)
Global PA		-0.01 (-0.03)		0.07 (0.08)		0.15* (0.24)		0.04 (0.09)
Global NA		-0.02 (-0.04)		0.19** (0.19)		0.09 (0.13)		-0.05 (-0.10)
Global SWL		-0.08 (-0.10)		-0.02 (-0.01)		-0.01 (-0.01)		0.07 (0.09)
Global QEW		-0.03 (-0.08)		0.03 (0.06)		0.04 (0.10)		0.12 (0.41)
Global GLTEQ		0.01 (0.00)		0.01 (0.00)		-0.02 (0.00)		0.06 (0.00)
Episodic PA		X		-0.15 (-0.09)		0.37** (0.30)		0.50** (0.55)
Episodic NA		-0.09 (-0.16)		X		-0.14* (-0.19)		0.08 (0.15)
Episodic Sat		0.32**(0.40)		-0.19* (-0.14)		X		0.24**(0.32)
Episodic PE		0.47**(0.42)		0.12 (0.06)		0.26** (0.19)		X
Primary predictors								
Episodic HEPA frequency	0.02 (0.01)	-0.01 (-0.01)	-0.12 (-0.05)	-0.01 (-0.01)	0.13 (0.09)	0.04 (0.03)	-0.01 (-0.01)	-0.05 (-0.05)
Episodic HEPA duration	0.09 (0.00)	-0.02 (0.00)	-0.02 (0.00)	-0.04 (0.00)	0.04 (0.00)	0.05 (0.00)	0.00 (0.10)	0.06 (0.00)
Episodic HEPA effort	0.46**(0.40)	0.01 (0.01)	-0.04 (-0.02)	0.21* (0.11)	0.46**(0.35)	0.24** (0.17)	0.59**(0.58)	0.38** (0.37)
Model ΔR^2	0.23**	0.00	0.02	0.03	0.22**	0.04**	0.38**	0.11**
Model $R^2_{adj.}$	0.22**	0.50	-0.00	0.22	0.21**	0.46**	0.37**	0.58**

Note. PA = Positive Affect; NA = Negative Affect; SWL = Satisfaction with Life; QEW = Questionnaire for Eudaimonic Well-being; GLTEQ = Godin Leisure Time Exercise Questionnaire; Sat = Satisfaction with episode; PE = Personal Expressiveness; HEPA = Health Enhancing Physical Activity; frequency = total episodes; duration = total time; effort = mean effort. * - indicates statistical significance $p < .05$. ** - indicates statistical significance $p < .01$

Table 20
Multiple Regressions of Episodic HEPA on Psychological Need Satisfaction

	Episodic criteria					
	Competence		Autonomy		Relatedness	
Predictors	Model A	Model B	Model A	Model B	Model A	Model B
	β(B)	β(B)	β(B)	β(B)	β(B)	β(B)
Covariates						
Gender		0.11 (-0.01)		0.10 (0.25)		0.08 (0.25)
Health condition		-0.00 (-0.01)		-0.02 (-0.06)		-0.03 (-0.13)
Day of week		0.07 (0.08)		0.01 (0.01)		0.07 (0.10)
Global competence		0.25 (0.31)		0.18 (0.25)		0.10 (0.18)
Global autonomy		-0.12 (-0.16)		-0.09 (-0.13)		-0.03 (-0.05)
Global relatedness		-0.01 (-0.02)		-0.07 (-0.14)		0.06 (0.15)
Global PA		-0.14 (-0.28)		-0.04 (-0.08)		0.02 (0.04)
Global NA		-0.12 (-0.20)		0.01 (0.02)		-0.02 (-0.04)
Global SWL		-0.03 (-0.03)		-0.01 (-0.02)		-0.04 (-0.07)
Global QEW		0.01 (0.02)		0.00 (-0.00)		0.02 (0.07)
Global GLTEQ		0.07 (0.00)		0.10 (0.00)		0.08 (0.00)
Primary predictors						
Episodic HEPA frequency	0.05 (0.04)	0.04 (0.03)	0.11 (0.09)	0.09 (0.08)	-0.07 (-0.07)	-0.08 (-0.08)
Episodic HEPA duration	0.13 (0.00)	0.15 (0.00)	-0.02 (0.00)	-0.02 (-0.00)	0.12 (0.00)	0.11 (0.00)
Episodic HEPA effort	0.29** (0.24)	0.25** (0.21)	0.32** (0.31)	0.29** (0.28)	0.26** (0.30)	0.23** (0.26)
Model ΔR^2	0.11**	0.09**	0.10**	0.08**	0.10**	0.08**
Model $R^2_{adj.}$	0.10**	0.10**	0.09**	0.06**	0.09**	0.07**

Note. PA = Positive Affect; NA = Negative Affect; SWL = Satisfaction with Life; QEW = Questionnaire for Eudaimonic Well-being; GLTEQ = Godin Leisure Time Exercise Questionnaire; Sat = Satisfaction with episode; PE = Personal Expressiveness; HEPA = Health Enhancing Physical Activity; frequency = total episodes; duration = total time; effort = mean effort. * - indicates statistical significance $p < .05$. ** - indicates statistical significance $p < .01$.

Table 21

Multiple Regressions of Episodic Psychological Need Satisfaction on Well-Being

	Episodic criteria							
	Positive affect		Negative affect		Satisfaction		Expressiveness	
Predictors	Model A	Model B	Model A	Model B	Model A	Model B	Model A	Model B
	β(B)	β(B)		β(B)	β(B)	β(B)	β(B)	β(B)
Covariates								
Gender		0.04(0.09)		-0.14*(-0.20)		-0.04(-0.07)		-0.05(-0.15)
Health condition		-0.03(-0.09)		-0.21**(-0.41)		0.02(0.07)		-0.00(-0.00)
Day of week		0.06 (0.08)		0.03(0.02)		-0.03(-0.03)		-0.04(-0.05)
Global competence		-0.04(-0.06)		-0.07(-0.05)		0.07(0.08)		-0.04(-0.01)
Global autonomy		0.12(0.17)		-0.17(-0.13)		-0.07(-0.08)		-0.06(-0.10)
Global relatedness		0.01(0.02)		-0.04(-0.04)		0.05(0.08)		-0.13(-0.29)
Global PA		0.06(0.13)		0.00(0.00)		0.13(0.23)		-0.01(-0.02)
Global NA		0.00(0.01)		0.20**(0.21)		0.05(0.07)		-0.04(-0.08)
Global SWL		-0.07(-0.10)		-0.01(-0.00)		-0.02(-0.02)		0.09(0.13)
Global QEW		0.01(0.04)		0.02(0.03)		0.01(0.02)		0.10(0.35)
Global GLTEQ		-0.03(-0.00)		0.02(0.00)		-0.00(err)		0.08(0.00)
Episodic PA		X		-0.18(-0.10)		0.36**(0.29)		0.48**(0.52)
Episodic NA		-0.10(-0.18)		X		-0.13*(-0.19)		0.12(0.23)
Episodic SAT		0.32**(0.39)		-0.19*(-0.13)		X		0.32**(0.43)
Episodic PE		0.45**(0.42)		0.19(0.10)		0.35**(0.27)		X
Primary predictors								
Episodic competence	0.26**(0.27)	0.23**(0.24)	-0.12(-0.07)	-0.08(-0.05)	0.02 (0.02)	-0.07 (-0.06)	0.08 (0.09)	-0.03 (-0.04)
Episodic autonomy	0.27**(0.25)	0.22**(0.21)	0.02(0.01)	0.11(0.06)	0.27**(0.21)	0.11(0.08)	0.14 (0.15)	-0.12 (-0.11)
Episodic relatedness	0.31**(0.24)	0.13**(0.11)	-0.03(-0.01)	0.02(0.01)	0.15 (0.12)	-0.09(-0.06)	0.30**(0.26)	0.13*(0.11)
Model Δ R^2	0.49**	0.18**	0.01	0.00	0.14**	0.01	0.19**	0.02
Model $R^2_{adj.}$	0.48**	0.69**	-0.00	0.19	0.13**	0.46	0.18**	0.50

Note:* - indicates statistical significance $p < .05$. ** - indicates statistical significance $p < .01$. PA = Positive Affect; NA = Negative Affect; SWL = Satisfaction with Life; QEW = Questionnaire for Eudaimonic Well-being; GLTEQ = Godin Leisure Time Exercise Questionnaire; SAT = Satisfaction with episode; PE = Personal Expressiveness; HEPA = Health Enhancing Physical Activity; frequency = total episodes; duration = total time; effort = mean effort.

Table 22

Multiple Regressions of Episodic HEPA and Psychological Need Satisfaction on Well-Being

	Episodic criteria							
	Positive affect		Negative affect		Satisfaction		Expressiveness	
Predictors	Model A	Model B	Model A	Model B	Model A	Model B	Model A	Model B
	β(B)	β(B)	β(B)	β(B)	β(B)	β(B)	β(B)	β(B)
Covariates								
Gender		0.03(0.07)		-0.17*(-0.22)		-0.05(-0.09)		-0.08(-0.19)
Health condition		0.02(0.08)		-0.25**(-0.49)		-0.02(-0.07)		-0.08(-0.29)
Day of week		0.05(0.06)		0.02(0.01)		-0.03(-0.03)		-0.01(-0.02)
Global competence		-0.01(-0.01)		-0.12(-0.09)		0.03(0.03)		-0.06(-0.08)
Global autonomy		0.11(0.15)		-0.12(-0.10)		-0.09(-0.10)		-0.04(-0.05)
Global relatedness		0.01(0.03)		-0.07(-0.07)		0.00(0.00)		-0.14(-0.29)
Global PA		0.04(0.08)		0.06(0.07)		0.14(0.23)		0.04(0.10)
Global NA		0.01(0.01)		0.19*(0.19)		0.10(0.14)		-0.01(-0.01)
Global SWL		-0.06(-0.07)		-0.02(-0.02)		-0.02(-0.02)		-0.06(0.08)
Global QEW		-0.01(-0.03)		0.05(0.09)		0.07(0.18)		0.12(0.40)
Global GLTEQ		-0.01(0.00)		0.02(0.00)		-0.02(-0.00)		0.06(0.00)
Episodic PA		X		-0.13(-0.07)		0.37**(0.30)		0.43**(0.47)
Episodic NA		-0.06(-0.10)		X		-0.16*(-0.23)		0.00(0.00)
Episodic Sat		0.23**(0.29)		-0.23*(-0.17)		X		0.09(0.12)
Episodic PE		0.36**(0.33)		-0.00(0.00)		0.12(0.09)		X
Primary predictors/mediators								
Episodic HEPA frequency	0.00 (0.00)	-0.03 (-0.02)	-0.12(-0.05)	-0.02 (-0.01)	0.12 (0.08)	0.03 (0.02)	0.00 (0.00)	-0.04 (-0.03)
Episodic HEPA duration	0.04 (0.00)	-0.04 (0.00)	0.02(0.00)	-0.02 (0.00)	0.03 (0.00)	0.06 (0.00)	0.07 (0.00)	0.06 (0.00)
Episodic HEPA effort	0.26**(0.23)	-0.02 (-0.02)	0.02(0.01)	0.21*(0.11)	0.39**(0.29)	0.24**(0.17)	0.52**(0.52)	0.38**(0.36)
Episodic competence	0.22**(0.22)	0.19**(0.20)	-0.20(-0.12)	-0.11 (-0.06)	0.05 (0.04)	-0.01 (-0.01)	0.02 (0.03)	-0.04 (-0.04)
Episodic autonomy	0.21**(0.19)	0.21**(0.20)	0.05(0.03)	0.08 (0.04)	0.14 (0.11)	0.03 (0.03)	0.05 (0.05)	-0.09 (-0.09)
Episodic relatedness	0.26**(0.20)	0.13* (0.10)	-0.06(-0.03)	-0.01 (-0.00)	0.07 (0.05)	-0.09 (-0.05)	0.17 (0.15)	0.07 (0.06)
Model ΔR^2	0.50**	0.15**	0.05	0.03	0.26**	0.04*	0.42**	0.12**
Model $R^2_{adj.}$	0.48**	0.66**	0.02	0.21	0.24**	0.46*	0.40**	0.59**

Note. PA = Positive Affect; NA = Negative Affect; SWL = Satisfaction with Life; QEW = Questionnaire for Eudaimonic Well-being; GLTEQ = Godin Leisure Time Exercise Questionnaire; Sat = Satisfaction with episode; PE = Personal Expressiveness; HEPA = Health Enhancing Physical Activity; frequency = total episodes; duration = total time; effort = mean effort. * - indicates statistical significance $p < .05$. ** - indicates statistical significance $p < .01$

Table 23

Causal Steps Approach: HEPA on Positive Affect Through Mediators

Variable	Direct effect of predictor to outcome	Predictor to mediator	Mediator to outcome variable	Residual direct effect of predictor to outcome	Sobel mediation test statistic	BCa CI	Point Estimate
Frequency	-.05						
Competence		.23	3.92	-.05	.23	-.0263 - .0320	.0013
Autonomy		.64	4.23	-.07	.68	-.0238 - .0565	.0116
Relatedness		-.79	5.33	-.00	1.26	-.0649 - .0094	-.0214
Duration	.20**						
Competence		2.92**	4.12**	.08	2.80**	.0001 - .0011	.0005
Autonomy		1.46	4.63**	.11*	.65	-.0001 - .0009	.0003
Relatedness		2.56**	5.39**	.11	2.38*	.0001 - .0010	.0005
Effort	.51**						
Competence		5.28**	2.32*	.33**	4.58**	-.0333 - .1556	.0752
Autonomy		5.15**	2.24*	.34**	.98	.0267 - .1439	.0721
Relatedness		4.75**	3.57**	.37*	2.75**	.0276 - .1406	.0733

Note: Number of bootstrap resamples = 5000. BCa CI = Bias Corrected and Accelerated Confidence Intervals. *$p \leq .05$; **$p \leq .01$.

Table 24

Causal Steps Approach: HEPA on Negative Affect Through Mediators

Variable	Direct effect of predictor to outcome	Predictor to mediator	Mediator to outcome variable	Residual direct effect of predictor to outcome	Sobel mediation test statistic	BCa CI	Point Estimate
Frequency	-.10						
Competence		.10	-2.79**	-.10	-.10	-.0220 - .0111	.0078
Autonomy		.67	-1.93	-.10	-.57	-.0058 - .0124	.0103
Relatedness		-1.25	-1.81	-.12	.94	-.0021 - .0155	-.0031
Duration	-.03						
Competence		2.91**	-1.57	-.01	-1.32	-.0005 - .0002	.0002
Autonomy		1.41	1.06	-.02	-.74	-.0001 - .0003	.0000
Relatedness		2.44*	-.98	-.02	-.85	-.0002 - .0001	.0001
Effort	-.02						
Competence		5.36**	-1.68	.06	-1.58	-.0864 - .0198	.0117
Autonomy		5.18**	-.89	.04	-.87	-.0306 - .0576	.0179
Relatedness		4.89**	-1.05	.05	-1.01	-.0337 - .0178	.0077

Note: Number of bootstrap resamples = 5000. BCa CI = Bias Corrected and Accelerated Confidence Intervals. *$p \leq .05$; **$p \leq .01$.

Table 25

Causal Steps Approach: HEPA on Satisfaction Through Mediators

Variable	Direct effect of predictor to outcome	Predictor to mediator	Mediator to outcome variable	Residual direct effect of predictor to outcome	Sobel mediation test statistic	BCa CI	Point Estimate
Frequency	-.06						
Competence		.19	3.81	.09	.18	-.0101 - .0165	.0002
Autonomy		.83	4.80	.07	.80	-.0089 - .0660	.0105
Relatedness		-1.36	3.83	.12	-1.24	-.0456 - .0028	-.0109
Duration	.18**						
Competence		2.89**	3.75**	.13	2.24*	-.0005 - .0003	.0000
Autonomy		1.35	5.00**	.15*	1.28	.0000 - .0010	.0002
Relatedness		2.50**	3.58**	.14*	2.00*	.0000 - .0006	.0002
Effort	.46**						
Competence		5.16**	2.66**	.40**	2.33*	-.0297 - .0614	.0123
Autonomy		4.88**	3.09**	.39**	2.57**	-.0037 - .1120	.0365
Relatedness		4.78**	1.99*	.42**	1.80	-.0206 - .0655	.0146

Note: Number of bootstrap resamples = 5000. BCa CI = Bias Corrected and Accelerated Confidence Intervals. *$p \leq .05$; **$p \leq .01$.

Table 26

Causal Steps Approach: HEPA on Personal Expressiveness Through Mediators

Variable	Direct effect of predictor to outcome	Predictor to mediator	Mediator to outcome variable	Residual direct effect of predictor to outcome	Sobel mediation test statistic	BCa CI	Point Estimate
Frequency	-.06						
Competence		.10	9.66	-.06	.10	-.0074- .0242	.0008
Autonomy		.69	9.96	.29	.68	-.0099- .0545	.0060
Relatedness		-1.28	8.37	-.03	-.77	-.0577- .0193	-.0145
Duration	.23**						
Competence		2.92**	10.44**	.17**	2.80*	-.0002 - .0006	.0001
Autonomy		.70	3.17**	.20**	.65	.0000 - .0007	.0002
Relatedness		2.48**	8.77**	.17**	2.38*	.0001 - .0012	.0005
Effort	.63**						
Competence		5.38**	8.91**	.58**	4.58**	-.0251 - .0665	.0136
Autonomy		1.11	2.77**	.15*	.98	-.0417 - .0757	.0135
Relatedness		4.78**	3.44**	.56**	2.75**	.0144 - .1219	.0553

Note: Number of bootstrap resamples = 5000. BCa CI = Bias Corrected and Accelerated Confidence Intervals. *$p \leq .05$; **$p \leq .01$.

Appendix A
Research Ethics Board Clearance Letter

DATE: 10/28/2010

PRINCIPAL INVESTIGATOR: MACK, Diane - PEKN

FILE: 10-060 - MACK

TYPE: Masters Thesis/Project STUDENT: Benjamin Sylvester

SUPERVISOR: Diane Mack

TITLE: Daily Activities and Well-being: Understanding the activities and mechanisms contributing to well-being

ETHICS CLEARANCE GRANTED

Type of Clearance: NEW Expiry Date: 10/31/2011

The Brock University Research Ethics Board has reviewed the above named research proposal and considers the procedures, as described by the applicant, to conform to the University's ethical standards and the Tri- Council Policy Statement. Clearance granted from **10/28/2010 to 10/31/2011**.

The Tri-Council Policy Statement requires that ongoing research be monitored by, at a minimum, an annual report. Should your project extend beyond the expiry date, you are required to submit a Renewal form before **10/31/2011**. Continued clearance is contingent on timely submission of reports.

To comply with the Tri-Council Policy Statement, you must also submit a final report upon completion of your project. All report forms can be found on the Research Ethics web page.

In addition, throughout your research, you must report promptly to the REB:

a) Changes increasing the risk to the participant(s) and/or affecting significantly the conduct of the study;

b) All adverse and/or unanticipated experiences or events that may have real or potential unfavourable implications for participants;

c) New information that may adversely affect the safety of the participants or the conduct of the study;

d) Any changes in your source of funding or new funding to a previously unfunded project.

We wish you success with your research.

Approved:

Michelle McGinn, Chair

Research Ethics Board (REB)

Note: Brock University is accountable for the research carried out in its own jurisdiction or under its auspices and may refuse certain research even though the REB has found it ethically acceptable. If research participants are in the care of a health facility, at a school, or other institution or community organization, it is the responsibility of the Principal Investigator to ensure that the ethical guidelines and clearance of those facilities or institutions are obtained and filed with the REB prior to the initiation of research at that site.

Brock University

Research Ethics Board

Tel: 905-688-5550 ext. 3035

Email: reb@brocku.ca

Appendix B

Informed Consent

Title of Study: Daily Activities and Well-being: Understanding the activities and mechanisms contributing to well-being.
Principle Student Researcher: Ben Sylvester, Faculty of Applied Health Sciences, Brock University.
Principal Researcher: Dr. Diane E. Mack, Associate Professor, Department of Physical Education and Kinesiology, Faculty of Applied Health Sciences, Brock University

You are invited to participate in a study that involves research. The purpose of this study is to examine the activities people engage in and their relative contribution to well-being.

I understand that:

- I have received and read the letter of information provided to me through members of the research team.
- I understand that participation will involve completing a questionnaire that will take approximately 45-60 minutes on a single occasion.
- I understand that no known psychological or physical risks are associated with participation.
- I understand that background information requests the disclosure of personal information.
- I understand that there is no obligation to answer any question that I feel is invasive, offensive or inappropriate.
- I understand that I can either complete the questionnaire individually or at a mutually convenient time in the Behavioural Health Sciences Research Lab.
- I understand that the questionnaire will be returned to the research team in the envelope provided.
- I understand that members of the research team have secured procedures to ensure participant anonymity and confidentiality.
- I understand that my participation in this study is voluntary and that I may withdraw from the study at any time and for any reason without penalty by informing a member of the research team of my decision.
- I understand that only members of the research team named above will have access to the data. Data will be entered on a computer stored in a locked office at Brock University. Hard copies of your data will be secured in a locked file in the Behaviour Health Sciences Research Lab (WH 141).
- I understand that data will be destroyed five years following completion of the study.
- I understand that participants gain a better understanding of the role of how my daily activities are associated with well-being. Further, additional insight into varied approaches to conducting research at the university-level may assist in informing future research endeavours that you may wish to pursue.

- I understand that the results of this study will be distributed in academic journal articles and conference presentations and a summary of the results will be made available to the participants in this study.
- As indicated by my consent, I acknowledge that I am participating feely and willingly.

I agree to participate in this study described above. I have made this decision based on the information I have read in the Information-Consent Letter. I have had the opportunity to receive any additional details I wanted about the study and understand that I may ask questions in the future. I understand that I may withdraw this consent at any time.

I acknowledge by the submission of the research package constitutes my consent to participate.

If you have any questions about this study or require further information, please contact the Principal Student Investigator using the contact information provided above. This study has been reviewed and received ethics clearance through the Research Ethics Board at Brock University (File# 10-060). If you have any comments or concerns about your rights as a research participant, please contact the Research Ethics Office at (905) 688-5550 Ext. 3035, reb@brocku.ca.

Appendix C

Letter of Information

Title of Study: Daily Activities and Well-being: Understanding the activities and mechanisms contributing to well-being

Principal Researcher: Dr. Diane Mack, Associate Professor, Dept. of Physical Education and Kinesiology

Principle Student Researcher: Benjamin Sylvester, BKin, MA Candidate (Health and Physical Education), Faculty of Applied Health Sciences.

Dear Participant,

Introduction: The research project that you are being invited to participate in is entitled, "Daily Activities and Well-being: Understanding the activities and mechanisms contributing to well-being". The study comprises one portion of the graduate work conducted by Benjamin Sylvester under the supervision of Diane Mack, PhD.

Purpose: The purpose of this study is to examine the varied activities that you engage in and their contribution to well-being in university students. How people spend their time and the activities they engage in are known to confer a number of psychological health benefits. The research we are doing in this study is designed to assess various indices of physical activity on dimensions of well-being. Attention to the specific activities you are involved in is important for researchers to learn why we do what we do. The following criteria will be used to determine participant eligibility for this study:

1. Currently enrolled in Undergraduate courses at a Canadian University
2. 18 years of age or older
3. Able to read and converse in English

Involvement: Your involvement would be greatly appreciated and will help to further our understanding of the role played by daily activities on well-being. Should you choose to participate, we will ask that you complete a questionnaire on one occasion. You can either complete study materials individually at a time convenient for you, or you have the option of completing study materials at a mutually convenient time in the Behavioural Health Sciences Lab (WH 141). Should you choose to complete study materials individually, a self-addressed, stamped return envelope will be provided for your convenience. Completion of the questionnaire is expected to take approximately 45-60 minutes of your valuable time. One sample question is: "I feel more complete or fulfilled when engaging in this activity than I do when I engage in most other activities". Relevant

demographic questions will also be queried such as age and gender to ensure that the people who participate in this project are representative of university students in Canada.

Benefits: There are a number of benefits associated with participating in this study. First, it is important to know how you spend your time throughout the day. Second, it is important to understand how your well-being may be promoted through your engagement in varied activities. Third, insight into varied approaches to conducting research at the university-level which may assist in informing future research endeavours that you may wish to pursue. Finally, research benefits the larger community by providing information that will likely be used to improve the lives of university students.

Feedback: Written summary of our results from this study will be made available to you at your request. Should you wish to receive a summary, please complete the Debriefing Form located at the end of the questionnaire. Our findings will also be disseminated in academic journals and conference presentations; however, the specific identity the participants in the study will not be disclosed.

Confidentiality: Any information that is provided from participants will be treated with confidentiality and access to all information that might identify participants will be limited to members of the research team named above. Upon receipt of completed study materials, your informed consent and debriefing form will be immediately separated from the questionnaire such that your name cannot be associated with your individual responses. As there is no identifying information (e.g., name or student numbers) recorded on your survey instrument, your anonymity is assured. All data will be kept on a secured password protected computer and hard copies in a locked file in the Behavioural Health Sciences Research Lab (WH 141). Consistent with guidelines that control the collection and storage of scientific information in Canada, all data collected for this study will be destroyed five years following the completion of the investigation.

Participation: Participation in this study is voluntary and individuals may decline answering any question(s) that they choose. There are no known psychological or physical risks associated with participation. You may choose to decline or withdraw your participation at any time throughout the course of the study. However, your participation is needed and would be appreciated as it will improve the conclusions derived from this investigation.

Sponsorship: The study has been reviewed and has received ethics clearance through the Research Ethics Board at Brock University (File #: 10-060). This project is funded by grant awarded to the investigators by the Social Sciences and Humanities Research Council of Canada.

Should you have any further questions concerning the study in general please feel free to contact members of the research team: Benjamin Sylvester (905) 688-5550 extension 5564 or by e-mail at bs05ln@brocku.ca or Diane Mack PhD at (905) 688-5550 extension 4360 or by e-mail at dmack@brocku.ca. Additionally, concerns about your involvement in the study may also be directed to the Research Ethics Officer in the Office of Research Services at (905) 688-5550 extension 3035.

Thank you for your interest and involvement in this study.

Sincerely,

Benjamin Sylvester, BKin

MA Candidate (Health and Physical Education)
Faculty of Applied Health Sciences

E-mail: bs05ln@brocku.ca

Diane Mack, Ph.D.

Associate Professor

Appendix D

Packet 1

First we would like to ask for some background information about you.

1. What is your age? _____

2. What is your gender? ☐ Male ☐ Female

3. What is the highest level of education you have completed?

☐ Some college/ university ☐ College diploma/ university degree

☐ Graduate degree ☐ Some graduate school

4. What is your current marital status?

☐ Single ☐ Married/ common law ☐ Divorced/separated ☐ Widowed

5. Which of the following categories best describes you?

☐ African Canadian ☐ Asian Canadian

☐ Aboriginal peoples of Canada ☐ South Asian/Indian Subcontinent

☐ Hispanic ☐ Multi-racial

☐ Caucasian

☐ Other, please specify: _____

Have you been diagnosed with a chronic health condition (e.g., asthma, diabetes, hypertension, etc.)?

☐ Yes ☐ No

Thank you! You may now start on Packet 2

Packet 2

In this Packet we want to know about YOU generally. How you typically feel and what you typically do.

This scale consists of a number of words that describe different feelings and emotions. Read each ite and then mark the appropriate answer in the space next to that word. Indicate to what extent you generally feel this way, that is, how you feel on average.

	Very Slightly or Not at All	A Little	Moderately	Quite a Bit	Extremely
Inspired	1	2	3	4	5
Enthusiastic	1	2	3	4	5
Excited	1	2	3	4	5
Determined	1	2	3	4	5
Alert	1	2	3	4	5
Distressed	1	2	3	4	5
Scared	1	2	3	4	5
Upset	1	2	3	4	5
Nervous	1	2	3	4	5
Afraid	1	2	3	4	5

Below are five statements with which you may agree or disagree. Using the 1 -7 scale below, indicate your agreement with each item by placing the appropriate number on the line preceding that item. Please be open and honest in your responding. The 7-point scale is as follows

	Strongly Disagree	Disagree	Slightly Disagree	Neither agree nor Disagree	Slightly agree	Agree	Strongly Agree
1. In most ways my life is close to my ideal.	1	2	3	4	5	6	7
2. The conditions of my life are excellent.	1	2	3	4	5	6	7
3. I am satisfied with my life.	1	2	3	4	5	6	7
4. So far I have gotten the important things I want in life.	1	2	3	4	5	6	7
5. If I could live my life over, I would change almost nothing.	1	2	3	4	5	6	7

This questionnaire contains a series of statements that refer to how you may feel things have been going in your life. Read each statement and decide the extent to which you agree or disagree with it. Try to respond to each statement according to your own feelings about how things are actually going, rather than how you might wish them to be.

	Strongly Disagree				Strongly Agree
1. I find I get intensely involved in many of the things I do each day.	0	1	2	3	4
2. I believe I have discovered who I really am.	0	1	2	3	4
3. I think it would be ideal if things came easily to me in my life.	0	1	2	3	4
4. My life is centered around a set of core beliefs that give meaning to my life.	0	1	2	3	4
5. It is more important that I really enjoy what I do than that other people are impressed by it.	0	1	2	3	4
6. I believe I know what my best potentials are and I try to develop them whenever possible.	0	1	2	3	4
7. Other people usually know better what would be good for me to do than I know myself.	0	1	2	3	4
8. I feel best when I'm doing something worth investing a great deal of effort in.	0	1	2	3	4
9. I can say that I have found my purpose in life.	0	1	2	3	4
10. If I did not find what I was doing rewarding for me, I do not think I could continue doing it.	0	1	2	3	4
11. As yet, I've not figured out what to do with my life.	0	1	2	3	4
12. I can't understand why some people want to work so hard on the things that they do.	0	1	2	3	4
13. I believe it is important to know how what I'm doing fits with purposes worth pursuing.	0	1	2	3	4
14. I usually know what I should do because some actions just feel right to me.	0	1	2	3	4
15. When I engage in activities that involve my best potentials, I have this sense of really being alive.	0	1	2	3	4
16. I am confused about what my talents really are.	0	1	2	3	4
17. I find a lot of the things I do are personally expressive for me.	0	1	2	3	4
18. It is important to me that I feel fulfilled by the activities that I engage in.	0	1	2	3	4
19. If something is really difficult, it probably isn't worth doing.	0	1	2	3	4
20. I find it hard to get really invested in the things that I do.	0	1	2	3	4
21. I believe I know what I was meant to do in life.	0	1	2	3	4

Please read each of the following items carefully, thinking about how it relates to your life, and then indicate how true it is for you.

	Not at all True			Somewhat True			Very True
1. I feel like I am free to decide for myself how to live my life.	0	1	2	3	4	5	6	7
2. I really like the people I interact with.	0	1	2	3	4	5	6	7
3. Often, I do not feel very competent.	0	1	2	3	4	5	6	7
4. I feel pressured in my life.	0	1	2	3	4	5	6	7
5. People I know tell me I am good at what I do.	0	1	2	3	4	5	6	7
6. I get along with people I come into contact with.	0	1	2	3	4	5	6	7
7. I pretty much keep to myself and don't have a lot of social contacts.	0	1	2	3	4	5	6	7
8. I generally feel free to express my ideas and opinions.	0	1	2	3	4	5	6	7
9. I consider the people I regularly interact with to be my friends.	0	1	2	3	4	5	6	7
10. I have been able to learn interesting new skills recently.	0	1	2	3	4	5	6	7
11. In my daily life, I frequently have to do what I am told.	0	1	2	3	4	5	6	7
12. People in my life care about me.	0	1	2	3	4	5	6	7
13. Most days I feel a sense of accomplishment from what I do.	0	1	2	3	4	5	6	7
14. People I interact with on a daily basis tend to take my feelings into consideration.	0	1	2	3	4	5	6	7
15. In my life I do not get much of a chance to show how capable I am.	0	1	2	3	4	5	6	7
16. There are not many people that I am close to.	0	1	2	3	4	5	6	7
17. I feel like I can pretty much be myself in my daily situations.	0	1	2	3	4	5	6	7
18. The people I interact with regularly do not seem to like me much.	0	1	2	3	4	5	6	7
19. I often do not feel very capable.	0	1	2	3	4	5	6	7
20. There is not much opportunity for me to decide for myself how to do things in my daily life.	0	1	2	3	4	5	6	7
21. People are generally pretty friendly towards me.	0	1	2	3	4	5	6	7

Consider a typical week (7 days), how many times on the average do YOU do the following kinds of exercise for more than 15 minutes during your free time (write the appropriate number in each box for each level of activity intensity)?

Intensity of the activity	Times per week
• Mild (minimal effort, no perspiration) (e.g., easy walking, yoga, bowling, shopping, light housekeeping (e.g., vacuuming, washing dishes), slow dancing)	
• Moderate (not exhausting, light perspiration) (e.g., fast walking, carrying light loads, bicycling at a regular pace, easy swimming, dancing)	
• Strenuous (heart beats rapidly, sweating) (e.g., running or jogging, carrying groceries or heavy objects (25+lbs) upstairs, hockey, shovelling heavy snow)	

Packet 3

In this packet we want to know about what physical activity YOU did YESTERDAY.

Yesterday

We would like to learn what physical activity you did and how you felt *yesterday*. Some days you may be more active than others. Here we are only asking you about *yesterday*.

Because many people find it difficult to remember what exactly they did and experienced, we will do this in three steps:

1. On the next page, we will ask you when you woke up and when you went to sleep yesterday.

2. We'd like you to report what physical activity you did yesterday by reconstructing what your day was like, as if you were writing in a diary. What did you do and experience? Who were you with? How did you feel? Answering the questions on the next page will help you to reconstruct your day.

The following statements pertain to your participation in physical activity yesterday. For the purposes of these statements, physical activity is defined as...

- Any bodily movement produced by the skeletal muscles that result in a substantial increase over the body's energy expenditure.
- Physical activity can, in addition to and instead of, structured and planned exercise and sports can also be comprised of other forms of physical activity such as commuting, running errands on foot or bicycle, and leisure time hobbies.

3. After you have finished reconstructing your day, we will ask you specific questions about each episode (these questions are in Packet 4). In answering these questions, we'd like you to consult your diary page and the notes you made to remind you of what you did, how you felt and how meaningful it was.

To begin, please circle the day of the week that YESTERDAY was:

Monday Tuesday Wednesday Thursday Friday

Diary Pages

About what time did you wake up yesterday? _____ am/pm (please circle)

And when did you go to sleep? _____ am/pm (please circle)

On the next three pages, please describe the physical activity you did. Think of your day as a continuous series of scenes or episodes in a film. Give each episode a brief name that will help you remember it (for example, "commuting to work", or "walking with B", where B is a person or a group of people).

Write down the approximate times at which each episode began and ended. The episodes people identify usually last between 15 minutes and 2 hours. Indications of the end of an episode might be going to a different location, ending one activity and starting another, or a change in the people you are interacting with.

i.e., 7:30am -8:00 am Walked to school

The following page is constructed to help you recall all the physical activity episodes you did yesterday. There is room to list 10 episodes, although you may not need that many, depending on your day. It is not necessary to fill up all of the spaces – use the breakdown of your day that makes the most sense to you and best captures what you did, how you felt and how meaningful it was.

Try to remember each episode in detail, and write a few words that will remind you of exactly what was going on. Also, try to remember how you felt, and how meaningful activities were during each episode. What you write only has to make sense to you, and to help you remember what happened when you are answering the questions in Packet 4.

What you write in your diary will not be seen by anybody else. Packet 3 is yours to keep if you wish – you don't have to turn it in with the rest of your questionnaire.

Physical Activity Episodes

Physical Activity happened? Episode Name meaningful?	Time it Began	Time it Ended	Notes to yourself: What What did you feel? Was it
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Please look over your diary once more. Are there any other episodes that you'd like to revise or add more notes to? Is there an episode that you would want to break up into two parts? If so, please go back and make the necessary adjustments on your diary pages. If not, you may go on to Packet 4.

Packet 4

How Did You Feel Yesterday?

We would like to learn in more detail about what happened, how you felt and the meaning associated with the physical activities you reported during each of the episodes you engaged in yesterday. Please answer the questions for every episode you recorded, in Packet 3 beginning with the first physical activity episode you identified. Please use the notes on your diary pages (Packet 2) as often as you need to.

It is very important that we get to hear about all of the physical activity episodes you experienced yesterday, so please be sure to answer the questions for each activity you engaged in.

First Physical Activity Episode

This episode began at _____ and ended at _____.

What were you doing? _____.

Were you interacting with anyone (including on the phone/ texting etc)? Please check all that apply.

- ☐ Spouse/significant other
- ☐ Friends
- ☐ Co-workers/customers
- ☐ No, I was alone
- ☐ My family
- ☐ Classmates/students
- ☐ Professor/teaching assistant
- ☐ Other people not listed

All things considered, how satisfied are you with this physical activity episode?

Very Unsatisfied Very Satisfied

-3 -2 -1 0 1 2 3

Please rate the extent to which you had each of these three types of experiences during this activity.

	Very Little						Very Much
Felt generally competent and able in what I attempted.	1	2	3	4	5	6	7
Felt generally autonomous and choiceful in the activity I did.	1	2	3	4	5	6	7
Felt generally related and connected to the people I spent time with.	1	2	3	4	5	6	7

Please indicate the degree to which you experienced each of the following moods during this episode on a scale of 1 (not at all) to 7 (extremely).

	Not at all						Extremely
1. Pleased.	1	2	3	4	5	6	7
2. Happy	1	2	3	4	5	6	7
3. Enjoyment/fun.	1	2	3	4	5	6	7
4. Joyful.	1	2	3	4	5	6	7
5. Worried/anxious	1	2	3	4	5	6	7
6. Frustrated.	1	2	3	4	5	6	7
7. Angry/hostile.	1	2	3	4	5	6	7
8. Unhappy.	1	2	3	4	5	6	7
9. Depressed/blue.	1	2	3	4	5	6	7

To what extent do you agree with each of the following statements?

	Strongly Disagree						Strongly Agree
1. This activity gave me my greatest feeling of really being alive.	1	2	3	4	5	6	7
2. When I engaged in this activity I felt more intensely involved than I do when I engage in most other activities.	1	2	3	4	5	6	7
3. This activity gave me my strongest feeling that this is who I really am.	1	2	3	4	5	6	7
4. When I engaged in this activity I felt that this is what I was meant to do.	1	2	3	4	5	6	7
5. I felt more complete or fulfilled when I engaged in this activity than I do when I engage in most other activities.	1	2	3	4	5	6	7
6. I felt a special fit or meshing when I engaged in this activity.	1	2	3	4	5	6	7

Please rate the extent to which you had each of these experiences during this activity.

	Not at All						Very Much
Attention was focused	0	1	2	3	4	5	6
Put forth effort	0	1	2	3	4	5	6

Next Episode

Now look at your Diary and select the episode that immediately followed the one you just rated.

This is episode number _____.

This episode began at _____ and ended at _____.

What were you doing? _____.

Were you interacting with anyone (including on the phone/ texting etc)? Please check all that apply

- ☐ Spouse/significant other
- ☐ Friends
- ☐ Co-workers/customers
- ☐ No, I was alone
- ☐ My family
- ☐ Classmates/students
- ☐ Professor/teaching assistant
- ☐ Other people not listed

All things considered, how satisfied are you with this physical activity episode?

Very Unsatisfied Very Satisfied

-3 -2 -1 0 1 2 3

Please rate the extent to which you had each of these three types of experiences during this activity.

	Very Little						Very Much
Felt generally competent and able in what I attempted.	1	2	3	4	5	6	7
Felt generally autonomous and choiceful in the activity I did.	1	2	3	4	5	6	7
Felt generally related and connected to the people I spent time with.	1	2	3	4	5	6	7

Please indicate the degree to which you experienced each of the following moods during this episode on a scale of 1 (not at all) to 7 (extremely).

	Not at all						Extremely
1. Pleased.	1	2	3	4	5	6	7
2. Happy	1	2	3	4	5	6	7
3. Enjoyment/fun.	1	2	3	4	5	6	7
4. Joyful.	1	2	3	4	5	6	7
5. Worried/anxious	1	2	3	4	5	6	7
6. Frustrated.	1	2	3	4	5	6	7
7. Angry/hostile.	1	2	3	4	5	6	7
8. Unhappy.	1	2	3	4	5	6	7
9. Depressed/blue.	1	2	3	4	5	6	7

To what extent do you agree with each of the following statements?

	Strongly Disagree						Strongly Agree
1. This activity gave me my greatest feeling of really being alive.	1	2	3	4	5	6	7
2. When I engaged in this activity I felt more intensely involved than I do when I engage in most other activities.	1	2	3	4	5	6	7
3. This activity gave me my strongest feeling that this is who I really am.	1	2	3	4	5	6	7
4. When I engaged in this activity I felt that this is what I was meant to do.	1	2	3	4	5	6	7
5. I felt more complete or fulfilled when I engaged in this activity than I do when I engage in most other activities.	1	2	3	4	5	6	7
6. I felt a special fit or meshing when I engaged in this activity.	1	2	3	4	5	6	7

Please rate the extent to which you had each of these experiences during this activity.

	Not at All						Very Much
Attention was focused	0	1	2	3	4	5	6
Put forth effort	0	1	2	3	4	5	6

If you have more episodes to rate, please ask the attendant for additional forms.

If you have rated all of your episodes, including the last episode before you went to bed, you have completed the questionnaire about your activities.

Please proceed to the final question.

1. Yesterday, how many times did you do the following kinds of exercise for **more than 15 minutes** during your free time (write on each line the appropriate number).

Number of times yesterday

a) Strenuous exercise (heart beats rapidly) _____

(e.g., running, jogging, heavy lifting, carrying groceries or heavy objects (25+lbs) upstairs, hockey, squash, moving furniture, shoveling snow, basketball, cross country skiing, judo,

roller skating, vigorous swimming)

b) Moderate exercise (not exhausting) _____

(e.g., fast walking, easy swimming, snowblowing, easy bicycling, volleyball, alpine skiing, popular and folk dancing)

c) Mild exercise (minimal effort) _____

(e.g., yoga, easy walking, light housekeeping (e.g. washing dishes, vacuuming), bowling, snow-mobiling)

Thank you very much for your participation.

Appendix E

Debriefing Form

Brock University, Faculty of Applied Health Sciences

Debriefing Form

If you wish to receive a summary of the major findings from this study, please provide either your mailing address or your e-mail in the space provided below:

E-mail Address: _____

OR

Mailing Address: _____

_____

_____

_____

_____